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and its efficiency in epitheliomas of the skin is well known. In many cases of non-malignant inflammatory diseases, such as carbuncles, chronic indolent ulcers, and intractable infections of the skin, the cautery brings about healing when all previous treatment has been ineffectual. Whenever sterilization is required, heat is the most dependable of all agents.

It is quite natural, therefore, because of the striking effect of heat on malignant and non-malignant ulceration that the use of the cautery should be adopted in the treatment of chronic ulcerations in the stomach and duodenum. In 1913 we began the use of the actual cautery in the Clinic in selected cases of gastric ulcer and it has now become the most frequently employed procedure in the Clinic in the surgical management of gastric ulcer and has also been found applicable to certain types of duodenal ulcer. The results have been most gratifying. Up to July 1921 the cautery had been used in 437 cases of gastric ulcer in the Clinic. There has been an operative mortality of 1.87 per cent. in this series, less than half the average mortality rate of all other types of operations for gastric ulcer in the Clinic, and at least 80 per cent. of the patients have been afforded relief from symptoms, while the subsequent death-rate has been considerably lower than the average subsequent death-rate following all other operations. The latter fact is very significant, since it is to some extent, at least due to the specific destructive action which heat possesses for the cancer cell. The outstanding facts in the results of cautery excision and gastro-enterostomy for ulcer of the stomach are the low operative mortality the absence of postoperative morbidity the high percentage of satisfactory symptomatic results, and the low incidence of late sequelae. The cautery has been particularly effective in destroying the bleeding type of ulcer both gastric and duodenal, and the routine destruction of these ulcers has eliminated almost entirely the occurrence of subsequent gastric hemorrhage.

Experience with the cautery has shown that it is most applicable to the small ulcer on or involving the lesser curvature. In speaking of the size of an ulcer the size of the crater is referred

to If the crater is not more than 1 cm. in diameter the cautery can be most satisfactorily used whatever the extent of the induration around the crater may be. Cautery excision and gastro-enterostomy have been performed in more than 100 cases of ulcer of this type in the Clinic without operative mortality and with excellent subsequent results. Since these small ulcers on the lesser curvature are the type most commonly encountered often cautery excision can be employed and indications for the procedure may be anticipated in even more cases, if one may judge by the steady decrease in the number of chronic ulcers coming to operation in which delay has been responsible for those complications, which add hazard to any operative treatment and doubt as to the result. It has been in cases of this latter type that the immediate or late deaths following cautery excision and gastro-enterostomy have occurred since in seeking to establish the limitations of cautery excision the operation has been employed occasionally in fixed ulcers with such large craters that gastric resection would have been preferable had it not been contraindicated because of its difficulty and risk under the existing conditions. Yet it has also been in such cases that most remarkable results have followed the thorough cauterization of the lesion. The situation of the ulcer occasionally makes even cautery excision difficult, but only very rarely is an ulcer so high on the lesser curvature that it cannot be destroyed safely with the cautery. The value of the cautery in the bleeding type of ulcer has already been mentioned. In ulcers of the posterior wall of the stomach the cautery is used either for a transgastric excision or for the cauterization of the edges of the opening of the stomach after it has been separated from the pancreas. On the anterior wall the cautery is a very safe and simple method of excising an ulcer.

TECHNIC

The technic of cautery excision of gastric ulcer as it is now carried out in the Clinic is essentially the same as that originally proposed. The ulcer is elevated by a finger hooked around the lesser curvature and a flap of gastrophrenic omentum which is

Invariably thickened over the site of the ulcer is carefully dissected off (Fig 504). If this dissection includes the thickened peritoneal coat of the stomach, often a grayish-black spot is found which is the external opening of the chronic perforation which develops in many chronic gastric ulcers (Fig 504). The tract of the perforation is sometimes tortuous, but it usually leads to the center of the crater of the ulcer so that a probe

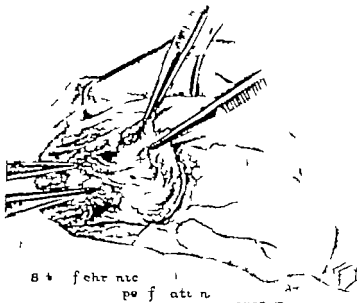


Fig 504.—Reflection of the gastrohepatic flap exposes the perforation, often grayish-black spot.

carried through the fistula into the cavity of the stomach serves as a guide for the direction of the cautery through the gastric wall. Experience will soon show the necessity of being absolutely certain of the size and location of the crater of the ulcer before the perforation is made with the cautery. Some of the few instances in which the crater of the ulcer has been missed by the cautery have undoubtedly been due to overlooking this important fact. After the crater of the ulcer has been located and outlined

exactly and the peritoneal surface prepared for the application of the cautery the tension which has been maintained by the finger elevating the lesser curvature of the stomach is released and small catch forceps are placed to encircle the indurated area in the manner shown in Fig. 505. If the portion of the

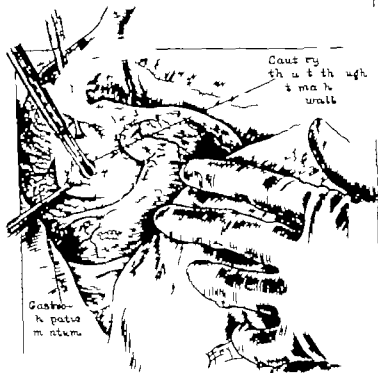


Fig. 505.—The region of the ulcer is elevated and the wall of the stomach at the site of the ulcer is burned through.

stomach including the ulcer is elevated by the forceps the ulcer may be burned out without danger of the point of the cautery coming in contact with healthy mucosa at any other point of the wall of the stomach. A Paquelin or electric cautery heated a dull red is applied at the point which marks the site of the per-

foration, or if this is not evident, at a point which apparently corresponds to the center of the crater of the ulcer. It is carried slowly through the base of the ulcer until the wall of the stomach is perforated completely. The cautery is then manipulated until the size of the opening which has been burned corresponds to or is larger than, the crater appeared to be (Fig. 505). The surrounding tissue may then be heated thoroughly without increasing the size of the opening and the selective action of heat on any actual or potential cancer-cell utilized. The vulnerability of the cancer-cell to heat is five times as great as that of the normal cell. Cautery excision, therefore, possesses distinct advantages in the few ulcers in which early malignant degeneration has already taken place. If all malignant or potentially malignant cells are not removed in the excision it is likely that the heat will destroy those remaining; moreover there is little or no danger of the dissemination of cancer-cells by the cautery. Another advantage of cautery excision is that the opening which is approximately the size of the crater is considerably smaller than that which would have remained after knife excision of the entire indurated area. This induration disappears when the central point of infection is destroyed just as it does when chronic ulceration in any other part of the body is dealt with in this way. There is no active hemorrhage when cauterization is carried out slowly so that no vessels need be ligated individually.

The opening is closed by interrupted sutures of chromicized catgut and reinforced by a continuous suture of the same material (Fig. 506). The flap of gastrobepatic omentum is then sutured to the wall of the stomach so that it thoroughly protects and conceals the site of the closure (Fig. 507). The operation is completed by a posterior gastro-enterostomy.

This general plan of procedure is applicable to all ulcers along the lesser curvature. The larger the crater the more extensive the burning particularly in cases in which it has not been possible positively to exclude malignancy and in which gastric resection does not seem warranted. The plan of taking a substantial slice from the base of the ulcer in doubtful cases and

subjecting it to immediate microscopic examination is a practice in the Clinic which has proved to be a valuable precaution and is quite permissible when thorough destruction of the ulcer is carried out immediately

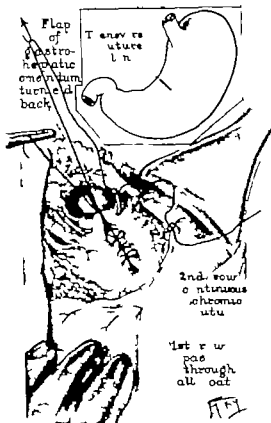


Fig. 506—The cauterized area is closed by 1 row of interrupted sutures and the suture line covered by 2 continuous sutures.

In duodenal ulcers practically only a puncture with the cautery is required because the actual lesion is so clearly in view and the ulcer crater is usually small. Thus far we have used the cautery chiefly in the bleeding type of ulcer in the duodenum

that is the ulcer which has been associated with a history of gastric or gastro-intestinal hemorrhages. The perforation of such an ulcer with the cautery added to the routine gastro-enterostomy apparently has prevented the danger of subsequent hemorrhages.

In ulcers of the posterior wall the cautery cannot be used in the same manner as for ulcers of the lesser curvature, because

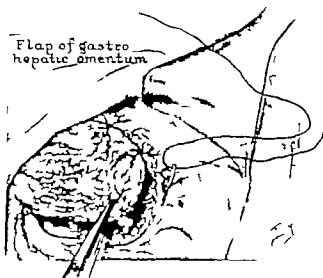


Fig. 507.—The flap of gastrohepatic omentum is sutured over the first suture line in interrupted stitches.

of their situation and because of the frequency with which they are attached to the pancreas. The method which is preferred in the Clinic for dealing with these ulcers is the preliminary separation of the stomach and pancreas through an opening in the gastrohepatic omentum, thoroughly heating the edges of the opening in the stomach, and sealing over the inflammatory area of the pancreas which has formed the basis of the ulcer. The gastric defect is then closed and a gastro-enterostomy made.

GASTROJEJUNOCOLIC FISTULAS FOLLOWING GASTRO ENTEROSTOMY

FRED W. RANKIN AND CHARLES H. MAYO

GASTRO-ENTEROSTOMY for the relief of symptoms of duodenal ulcer and in conjunction with other surgical procedures such as cauterly destruction or knife excision of gastric ulcers, gives perhaps as high a percentage of permanent relief as any surgical procedure which changes physiologic conditions to permit nature to effect a cure, but does not directly attack the pathologic lesion. Moynihan has attributed the vast majority of failures following gastro-enterostomy to three causes (1) Absence of an intrinsic lesion in the stomach or duodenum, (2) an incomplete operation which leaves a diseased organ, such as the appendix or gall-bladder which acts as a focus for recurrent infection, and (3) technical failures.

The formation of a gastrojejunal or a jejunal ulcer which results from one or more of the foregoing causes, or from other causes not yet observed, presents a picture so uniform in its symptomatology that a careful history and Roentgen study make accurate diagnosis comparatively certain. A search of the literature fails to reveal other adequate causes, although since the syndrome of this sequel to gastro-enterostomy has been understood it has attracted much attention. The incidence of gastrojejunal ulcer following gastro-enterostomy is within 1 to 3 per cent. and it seems likely that a better understanding of its nature and perfected roentgenologic technic will increase this percentage at the expense of the group of so-called relapsing ulcers of the duodenum or stomach. Bolton and Trotter Eusterman and others are authority for the statement that 10 per cent. of gastrojejunal ulcers cause gastrocolic fistulas or gastrojejunocolic fistulas as the case may be.

The first case of gastrocolic fistula reported was in 1903 published by Czerny and in 1907 Port and Reitzstein reported a case of gastrojejuno-colic anastomosis. Since that time 34 cases have been reported in the literature and reviewed by Boulton and Trotter who had 4 cases of their own.

In 101 cases of ulcer at or near the gastrojejunostomy anastomosis (reported by Judd) in which operation was performed at the Mayo Clinic, 6 fistulas between the stomach and bowel were found. This percentage of incidence is much the same as that of other observers who place it at from 1 to 2 per cent. In 55 of these cases the primary operation had been performed in the Clinic, and in 46 it had been performed elsewhere. All of our cases of gastrocolic fistula occurred in males, a fact not surprising when it is remembered that the ratio of males to females with jejunal ulcer is 7 to 1 while with primary duodenal ulcer it is $2\frac{1}{2}$ to 1 (Eusterman).

ETIOLOGY

In seeking an explanation for postoperative fistula between the stomach and bowel it seems logical to attempt to ascertain the causative factors of both the primary ulcer for which the gastro-enterostomy was made and the jejunal ulcer whose extension causes the pathologic anastomosis. Trauma to the operative field is suggested as a possible cause of jejunal ulcer and must be given some consideration, but a number of cases are reported in which clamps were not used on either the stomach or bowel during the anastomosis. The location of the ulcer below the anastomosis on the efferent loop about 10 cm. from the stoma is also evidence against this. In the Clinic series of 101 cases, 8 ulcers were definitely in the jejunum and 1 was 10 cm. below the gastro-enterostomy opening.

The formation of these ulcers is most frequently ascribed to mechanical factors, and yet without much direct evidence to substantiate the contention. The discussion as to the adaptability of the long-loop or the no-loop operation has caused surgeons to recognize that certain basic principles must be carried out to insure the greatest success, and most agree that the anastomosis should be made without a jejunal loop, that the

stoma on the gastric side should be at the lowest point on the greater curvature, that the suture material used should be absorbable, and that postoperative alkalization and adherence to prescribed diet should be insisted on. Inaccuracy in carrying out the technical details of the anastomosis unquestionably leads to trauma which, if prolonged and active, must play some part in the unfortunate postoperative sequelae. That unabsorbable suture material may have been a possible etiologic factor must be admitted and yet, since the adoption of chromicized catgut as the approximation suture, jejunal ulcers have continued to form. In the 55 cases in our series in which the primary operation had been performed in the Clinic, non-absorbable material was found in 9 and in the 46 cases in which the primary operation had been performed elsewhere non-absorbable material was found in 17. Generally it is embedded in the mucous layer of the stomach or jejunum and presents in the stoma often as much as 1 cm. or more of silk being free in the opening. Discarding such material has no doubt greatly reduced the frequency of ulcers at the stoma, although its importance as an etiologic factor can easily be overestimated.

Most observers are agreed that infection plays the principal part in the formation of ulcers at or near the gastro-enterostomy stoma. The cut tissues are constantly exposed at the time of operation and during the process of healing which as Flint has shown requires an average of fourteen days. Judd calls attention to the primary ulcer as the possible source of infection from which the abraded mucous membrane of the stoma may receive its bacteria, but he also points out that in 15 of the cases in his series there was no evidence of a primary ulcer. Whether or not there had been a primary ulcer or whether it had been in the mucosa on the posterior wall is problematic, but there was no visible scar on the mobile portion of the duodenum inspected. Moynihan has made similar observations in 2 of his cases. The inference is that no particular type of infection is essential but that some remote source, such as the teeth, tonsils, antra, nasopharynx, gall-bladder and appendix may be the underlying source.

There are no recorded cases of ulcer developing at the suture line of a plastic operation about the pylorus, nor has a resection of the stomach for cancer or ulcer been followed by this sequel. Judd points out that the principal cause may be the action of the acid gastric juice on the jejunal mucous membrane, which, unlike the duodenum is unaccustomed to receiving acid secretions. In the majority of cases of duodenal and gastric ulcers there are hyperacidity and hypersecretion, and these, unneutralized by bile and pancreatic juice, can readily have a deleterious effect on the jejunal mucosa.

SYMPTOMATOLOGY

The clinical manifestations of these fistulas usually are preceded for an indefinite time by the symptoms common to jejunal ulcer: a sudden onset of colic and diarrhea, which may or may not be accompanied immediately by vomiting of sterco-raceous material and belching of foul-smelling gas. Later when the opening becomes larger the latter symptoms are constant, and invariably are followed by severe wasting and great emaciation, although the patient usually continues to have a ravenous appetite. The jejunal ulcer may occur as soon as five weeks after operation or as late as nine and a half years, in spite of rigid ulcer management and continued alkalization. Usually the symptoms appear within from six months to a year after operation in the interval between the patient is comfortable and free from pain and distress. The onset is gradual and insidious and relief is not obtained as formerly by food and alkalis. Usually following such an onset the fistula between the colon and bowel is announced by a sudden attack of pain, diarrhea, and fecal vomiting. The diarrhea is produced at once on the entrance of food into the stomach and is stercoraceous; marked emaciation rapidly ensues. That this picture is not constant, however, is demonstrated in Case 306,138. The fistula sometimes is incomplete and apparently closes for months at a time, to open and bring about remission of symptoms.

Pain is not a symptom on which great dependence can be placed, since it is usually intermittent and more often lower in

the abdomen than the pain of the original duodenal ulcer. Not infrequently it is confined to the lower left quadrant, a fact for which no very satisfactory explanation seems to have been evolved. A palpable mass is almost always felt near the umbilicus, especially if the condition is of long standing.

The Roentgen ray is an invaluable aid in the diagnosis of this condition and is very accurate in calling attention to the fistula. In the 6 cases herewith reported the diagnosis has been confirmed by Roentgen ray and demonstrated at operation in each case. In jejunal ulcer the Roentgen ray is accurate in more than 75 per cent. of the cases.

TREATMENT

Obviously the treatment of this condition is surgical since a fistula which exists in such an infected tract can scarcely be expected to heal spontaneously. Three distinct problems present themselves for consideration in mapping out a plan to deal with this condition: (1) How may the fistula be eradicated most easily? (2) What measures shall be employed in dealing with the gastrojejunal or jejunal ulcer which caused the perforation? (3) What, if anything, shall be done to the original ulcer? Since the patient is emaciated and weakened, and for milder procedures, such as resection which necessarily carry a relatively high mortality even in robust patients, are more liable to result fatally than more simple ones which offer almost as many chances for relief. It seems fairly generally accepted that patients who once develop an ulcer at the stoma tolerate a gastro-enterostomy poorly and that better results are ultimately obtained if their gastro-enterostomy is undone and some other means of treating the original ulcer attempted. Trotter disagrees with this statement, and believes that better results are obtained by leaving the gastro-enterostomy after having obliterated the fistula. He also suggests a cecostomy as a possible safety valve on the fistulous tract after repair. When a fistula is present a tumor mass is usually felt at the site of the anastomosis owing to edema and thickening of the tissues at the base of the mesentery of the transverse colon which contains the

original stoma ulcer. The contraction which follows, plus the thickening in the tissues of the mesocolon, tends to pull the transverse colon into the line of anastomosis where it becomes fastened by the ulcerative process and only requires a progression of the ulceration and necrosis to produce a communication into the adjacent viscera (Figs. 508-510).

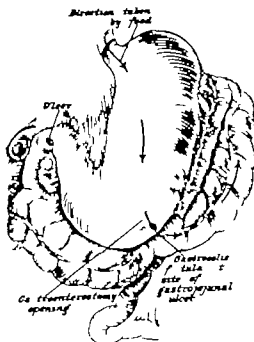


Fig. 508—Fistula formed by gastropyloric ulcer

Perhaps the old method of suturing the rent in the mesocolon to the anastomosis may have favored the formation of the fistula and the present tendency to suture the opening to 2.5 cm. above and on the stomach side may be preventive of this unfortunate result. By carefully dissecting down on the line of anastomosis a cleavage generally can be found which leads to the stomach and from there the colon can be dissected

free and the fistulous tract divided and inverted on both ends. This is much simpler than a massive resection and is a plan which

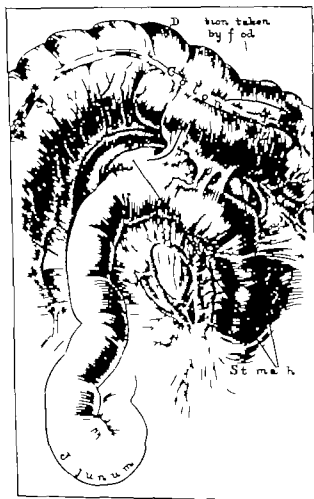


Fig. 509.—The under surface of the mesocolon. The colon attached to the site of the gastro-enterostomy.

we have been able to carry out in all our cases with one exception in which a resection was made and followed by a gastro-

enterostomy some months later. In one case an anastomosis was made between the stomach and duodenum after the original ulcer had been destroyed and the jejunal ulcer excised. If it is possible to mobilize the original duodenal ulcer it should be excised with or without pyloroplasty as seems best (Figs. 511-513).

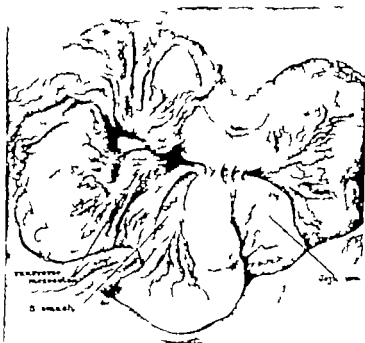


Fig. 510—Adhesions around the gastrojejunocolic fistula uniting the colon to the gastro-enterostomy

In the 31 cases of fistula reported by Bolton and Trotter the mortality was not high considering the seriousness of the condition. 27 patients were operated on, 21 recovered. Four patients were not operated on and died. In 2 of the patients who died following operation, however, the fistula was not repaired. In our series there has been no operative death. The

only patient who is not living died two years after operation from an intercurrent disease

CASE I (A7152)—Mr H. A. S. aged sixty years, came for examination August 5 1912. He had had stomach trouble for twenty years about once a month spells of belching sour stomach,

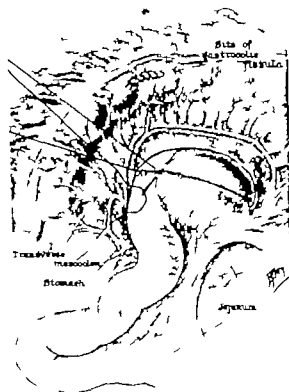


Fig. 511.—The repaired fistula and the beginning of new gastro-enterostomy

pain around the umbilicus, and occasionally vomiting. He had used a stomach-tube two or three times daily for twelve years. He had been operated on elsewhere six years previously and told that he did not have ulcer but an atonic, dilated stomach. Following the operation he had been well for eighteen months and

had gained 60 pounds. Then the symptoms returned with pain severe enough to require a hypodermic at times.

Stomach washings at the time of examination showed food remnants and quantities of yellow fluid with marked fecal odor. Urinalysis was negative.

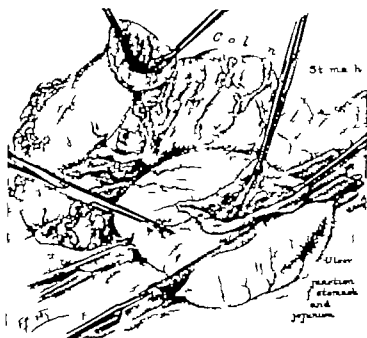


Fig. 512.—The gastro-enterostomy opened, exposing an ulcer at the line of the junction. The colon cut from the gastro-enterostomy and held open.

At operation, August 12, 1912, a contracted duodenal ulcer and colic fistula were found at the point of anastomosis between the transverse colon and the jejunum and fistula between the transverse colon and the stomach. A Roux gastro-enterostomy was made. Ten cubic centimeters of the transverse colon were resected with end-to-end suture and 10 cm. of jejunum at the site of the fistula with end-to-side anastomosis between the

proximal short jejunum and the distal end of the jejunum. The distal end of the jejunum was anastomosed to the posterior wall of the stomach at the site of the original gastro-enterostomy.

Convalescence was uneventful. According to the message from his relatives the patient died April 24 1914 from acute nephritis.

CASE II (A122 474)—Mr J N A. aged thirty four years, came for examination January 3 1916. He had had a gastro-enterostomy for duodenal ulcer performed in the Clinic in 1915.

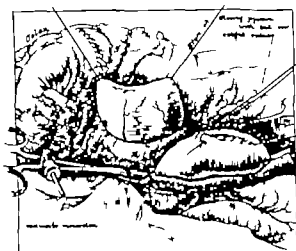


Fig. 513.—Colon, stomach, and jejunum closed.

He was free from symptoms for two or three months following operation, then he suffered from nocturnal vomiting with bile in the vomitus, pain in the left epigastrium and chest, tenderness, and loss of weight and strength.

A 250-c.c. specimen of vomitus showed total acids 70 free acid 50 food remnants 1 and blood 1 on a scale of 1 2 3 4 but no bile. The stomach emptied in seven hours. The urinalysis was negative.

February 22 1916 a gastrojejunal ulcer involving the outer wall of the right upper side of the stomach was excised, the

gastro-enterostomy cut off and a partial resection of the jejunum performed with end-to-end anastomosis.

April 5 1919 a posterior gastro-enterostomy was made for the bleeding type of ulcer involving practically the entire first portion of the duodenum. The pylorus was occluded. The ulceration was too extensive to warrant resection or local treatment. Considerable obstruction was present. The area of the former closure of the gastro-enterostomy and the anastomosis in the jejunum were in good condition.

A slight bronchopneumonia complicated his convalescence however the patient was able to leave the hospital on the fifteenth day following operation and was discharged from our care in good condition eighteen days later.

CASE III (A118,945) — Mr J. J. S. aged thirty-seven years, came for examination March 28 1917. He had had a gastro-enterostomy performed in our Clinic November 17 1914 for duodenal ulcer. He was well for eighteen months afterward and gained 25 pounds in weight. In September 1916 he had a hemorrhage from the stomach when he vomited about 2 quarts. He had pain in the abdomen every afternoon which could be relieved by food.

At the time of examination the patient was 30 pounds under weight. His bowels were constipated. The urinalysis was negative. The hemoglobin was 85 per cent. The stomach contents showed combined acids 54 and free hydrochloric acid 44. A roentgenogram showed the stomach to be adherent to the abdominal wall. A diagnosis of gastrojejunal ulcer was made.

At operation, May 2 1917 an ulcer was found between the jejunum and the transverse colon with a small fistula into the colon. The old gastro-enterostomy was cut off and the fistula closed. A gastroduodenostomy was made.

Convalescence was uneventful. The patient was discharged from the hospital on the tenth day and from our care nine days later.

CASE IV (A272,499) — Mr H. L. J. aged twenty-seven years, came for examination May 27 1919. He had had an appendectomy in 1908 and gastro-enterostomy in 1909 which for two

years relieved the low abdominal pain and vomiting from which he had suffered off and on since childhood. The pain returned in 1911 but was controlled by diet. Symptoms began again in 1917 with the sensation of fulness or heaviness at the umbilicus, belching of foul gas, and some vomiting after meals. The bowels had been loose for the past six years. He had lost 35 pounds in weight in six months.

The patient's chief difficulty at the time of examination was loss of weight and strength, general lassitude, and occasional vomiting of material with a fecal odor. He was markedly emaciated. Urinalysis was negative. The hemoglobin was 75 per cent. the leukocytes 5600. The total combined acids in the stomach contents were 90 and free acid 76. Roentgen examination showed the gastro-enterostomy. A diagnosis of gastrocolic fistula was made.

Exploration, June 20 1919 revealed an ileocolostomy and a portion of the small intestine united by lateral anastomosis to the transverse colon. the small gastro-enterostomy had perforated on to the colon through a gastrojejunal ulcer. Many adhesions were found in the upper portion of the abdomen and considerable scarring about the pylorus. The structures were separated and the openings in the ileum and colon closed. The openings in the stomach were converted into one and a new gastro-enterostomy made. The patient was dismissed from the hospital on the eleventh day and from our care twenty three days later in good condition. He has not been heard from since.

CASE V (A66,081) —Mr J. M. aged forty nine years, came for examination January 1 1920 with a history of appendectomy and cholecystostomy in 1909 and gastro-enterostomy in 1912 following which he had been well for six years. Two years before examination he had had a sudden spell of unconsciousness followed by vomiting and diarrhea, and watery stools every half hour for three days. Spells of diarrhea nausea with dull aching, and pain in the upper right quadrant of the abdomen recurred every three months and increased in severity. They had no relation to food intake. The patient had some dyspepsia between attacks. The later attacks had been characterized by belching

of sour gas with the odor of fecal matter and some vomiting of fecal material. At times there was blood in the stools.

The urinalysis was negative. The hemoglobin was 78 per cent. the leukocytes numbered 9200. The test-meal revealed total acids 22 free hydrochloric acid 16, and mucus 2 on a scale of 1 2 3 4. The Roentgen examination revealed a gastrocolic fistula.

At operation, December 21 1920 a perforating gastrojejunal ulcer with a gastrocolic fistula was found but no evidence of any foreign material. The stomach was dilated and scarred on the anterior surface. There was considerable inflammatory exudate. The old gastro-enterostomy was cut off and the gastrojejunal ulcer excised. The fistula was closed.

Convalescence was uneventful. The patient left the hospital on the fourteenth day and is now under our care.

CASE VI (A306,138) —Dr. D. B. aged thirty four years, came for examination February 12 1920. A gastro-enterostomy had been performed elsewhere five years before for pyloric ulcer with obstruction. The patient's first complaint was diarrhea. Since his childhood he had had symptoms of duodenal ulcer pain in the morning relieved by food and vomiting at night or in the morning of the food which he had eaten the day before. Gastro-enterostomy had relieved him until sixteen weeks before examination. He had lost 18 pounds in weight. Occasionally he vomited fecal matter.

Roentgen-ray examination revealed a communication between the stomach and the transverse colon. Urinalysis was negative with the exception of a slight amount of albumin. The hemoglobin was 78 per cent. the leukocytes numbered 15,800. A test-meal showed a total acidity of 40 to 50 and free hydrochloric acid 20 to 30. clay-colored fecal matter was found in the contents.

At operation, February 24 1920 a gastrocolic fistula and a duodenal ulcer were found. The opening between the gastro-enterostomy and the transverse colon admitted two fingers. The stomach was large. The fistulas were closed and a new gastro-enterostomy made.

The patient had an uneventful convalescence and was able to leave the hospital the twelfth day and to return home eleven days later. He reports that he is well.

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THE FORMATION OF A CLOACA IN THE TREATMENT OF EXSTROPHY OF THE BLADDER

CHARLES H. MAYO

In the early embryonic development of all mammals the rectum and the bladder united with the generative ducts, are included in a single receptacle, the cloaca. The cloaca persists for urine and feces in most vertebrates below the Eutheria. Its persistence in man is one of the most distressing anomalies. In the endeavor to relieve the condition the surgeon naturally considers transforming the rectum into a cloaca.

From 1896 to October 1 1921 72 patients with exstrophy of the bladder have been observed in the Clinic. The anomaly is rare, occurring according to various estimates, but once in from 30,000 to 50,000 births. In all cases the naturally associated anomalies absence of the pubic arch and epispadias, are noted. Other defects, such as relaxation of the sphincter and with prolapse of the rectum, are observed occasionally in young children, and still less frequently double ureter the absence of one kidney in the male undescended testicle, and in the female bifid uterus and double vagina (Figs. 514-515).

Exstrophy of the bladder is a serious condition. Statistics show that approximately 50 per cent. of the children thus afflicted die by the tenth year. In infancy and early childhood cleanliness is more easily maintained than in young adult and later life. The difficulty of preventing odor usually socially ostracizes the afflicted persons, who often are very intelligent and highly sensitive. Unless operation is performed early most of them cannot attend school. The exposed surface of the bladder is constantly irritated by absorbent dressings. As a result of such irritation, cancer developed in the wall of the bladder in 2 patients under thirty who came to the Clinic in 1 patient it was far advanced when discovered, and in the other

It followed successful transplantation of the ureters and removal of the bladder (Case II). The malignancy was not recognized for a number of months after the operation.

The placenta of human beings and of various animals has flat platelets scattered throughout, with a tuft of capillaries

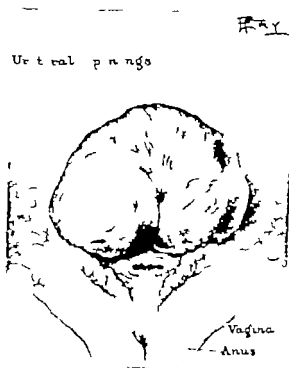


Fig. 514.—Ectopy of the bladder in the female

beneath each, much like glomeruli in the kidney. In the embryonic transformation of the nephrogenic tissue into true kidney tissue this anatomic condition undoubtedly serves the purpose of delivering the urinary output from the child's blood to the mother's blood. The wolffian body or mesonephros is a gland of urinary excretion. In one group of mammalian embryos, includ

ing the pig, sheep and cat, the wolffian body serves, as in birds and reptiles, until the true kidney can function. In a second group of mammalian embryos including the rat, rabbit, guinea-pig and man, there is a period after the wolffian body degenerates and before the kidneys reach functional ability in which urinary excretion is taken over by the placenta. The structural development enables the mother to eliminate toxins from the embryo by way of the urine. If the function of filtration fails before the bladder is fully prepared to receive urine the bladder probably



Fig. 515.—(Case 228,976) Exstrophy of the bladder in the male.

splits its anterior surface, including the urethra and the hypogastric canal to the umbilicus. This drags down the umbilicus and leaves it at the upper border of the bladder which is everted by an increase of abdominal pressure. Of the 72 patients in the Clinic only 1 had a normal umbilicus. This patient had the defect of the pubic arch a large open and uncontrolled outlet in the bladder and no urethra (Fig. 516). The rupture had probably occurred later in intra uterine life than the defect usually develops. The early distention of the bladder before union of the pubic bones prevents their union.

Early surgical measures for the relief of this distressing condition were mainly directed toward covering in the exposed mucosa of the bladder by some plastic operation, and if this object was accomplished it was deemed satisfactory although there was no prospect of controlling the bladder. The next step in the progress of treatment was the development of a cloaca by uniting the base of the bladder into the anterior wall of the



Fig. 316.—(Case 52,973.) The only patient in the Clinic in the series of 72 in which the umbilicus was present.

rectum, known as Mayo's operation. Moynihan devised a method of using a large area of the wall of the bladder. A still later method was the separate anastomosis of the ureters to the large bowel. Various means also were devised for controlling the small newly developed bladder or the ureters by utilizing the anal sphincter and delivering in front of the anal opening. I have previously stated that because of a difference in the absorb-

ing area a cloaca should be formed at the termination of the large bowel, and not at the cecum as has been attempted. It should be noted, too in producing uremic conditions in experimental work that urine must not only be eliminated by the kidneys but also it must be delivered from the body the urine from one kidney delivered into the small intestine does not cause death if the urine from the other kidney is delivered externally but death always occurs if the urine from both kidneys empties into the small intestine.

The dangers of forming a cloaca surgically are (1) Peritonitis, since the operation in most instances is intraperitoneal, and (2) ascending infection of the kidney from the union with the intestine. The latter danger may be overcome largely by the Coffey method of transplantation, placing the ureter 2.5 cm. or more between the mucous membrane of the colon and its muscular and peritoneal coats. This incorporation of the ureter into the wall of the gut leads to compression and closure from tension within the bowel by feces, liquids, or gases, and is safer than folding the entire thickness of the bowel around the ureter to form a stiff channel the so-called Russian or Peters method of union, which is similar to the Witzel method of enterostomy or gastrostomy. A moderate amount of pyelitis with slight fluctuation of temperature of 1 or 2 degrees often occurs for several days following each anastomosis. Naturally the cloaca can be developed only in persons who have a good sphincter and. One of the late results in persons who survive to youth or adult life with exstrophy of the bladder is contraction of the ureteral outlets on the surface of the bladder leading to cystic kidney and hydro-ureter on one or both sides. It is impossible to place large dilated ureters into the colon with any degree of safety and the kidney is less prepared to resist infection. If it can be determined that a ureteral orifice is contracted, it can be dilated or incised, giving considerable time to allow for shrinking of the ureter before an effort at anastomosis is made. This may apply to one kidney only and it involves some risk of pyelitis or nephritis.

The operation should be divided into three stages. If con-

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reaction from absorption. The third stage of the operation consists in the removal of the wall of the bladder including the

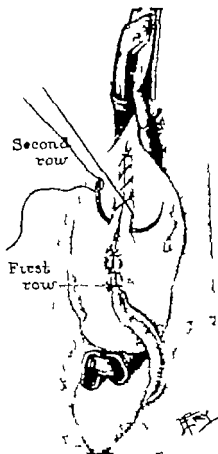


Fig. 518.—Entire area buried beneath the continuous approximating sutures in the serous coat.

stumps of ureter and closure of the opening with fascia (Figs. 517-518)

Of the 72 patients, 6 who came during our early work were operated on by the plastic method to cover the exposed surface

ditions seem favorable after exploration of the kidneys and ureters the right ureter is transplanted into the lower sigmoid thus there is some urinary absorption for from seven to ten days,

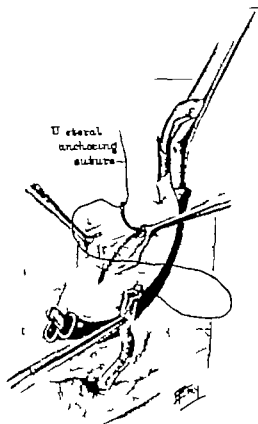


Fig. 517.—Macroscopic membrane exposed and opening made in macroscopic to receive the ureter

while the left kidney is delivering to the surface. The bowel's tolerance to urine is established by the first transplantation, and the remaining ureter can be transplanted with but little

the sigmoid just above the rectum. May 7th the left ureter was transplanted into the sigmoid. May 22d the bladder wall, which was thickened and indurated about the trigone, was removed, and the tissue beneath, which was markedly hyperplastic and thickened, was treated by Roentgen ray. At the end of a year the cloaca was functioning perfectly and the patient had control of urine for eight hours. In September 1919 she returned with carcinoma in the scar tissue in the area from which the bladder had been removed. Radium treatment was given. May 5 1921 the patient died from progressive carcinomatosis.

CASE III (A259,298)—Miss E. B. aged twenty-one years, was examined November 5 1919. She had reduplication of the uterus and vagina, a large hydronephrosis of the left kidney and hydro-ureter and exstrophy of the bladder. The right kidney and ureter were normal. The right ureter was transplanted into the rectosigmoid by the Coffey method. The left kidney was greatly distended, cystic, totally blocked, and dilated to the size of the fenum. The left ureter was, therefore, not transplanted and the kidney not removed. This patient is getting along nicely with the one functioning kidney and the cloaca.

CASE IV (A331,097)—J. S. a boy aged five years, was brought to the Clinic August 24 1920 because of exstrophy of the bladder. He had rectal prolapse and poor control of the sphincter ani. Should sphincter control develop re-examination and possible operation will be advisable.

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of the bladder and protect it from injury and irritation. A cloaca was formed by the Coffey method of transplanting the ureters in 36 patients, in 29 successfully. Two of these patients had but one kidney each, and one patient had a hydronephrosis and an atrophied kidney. Three patients were operated on by the Maydl-Moynihan method. 2 of them died of uremia. Twenty-seven patients were not operated on; most of them were too young, some were too old, or they had renal complications. One patient was fifty-two years of age; in his case Watson's nephrostomy might have been considered. A few of the children had not acquired complete control of the rectal sphincter and had varying degrees of prolapse; and consequently operation has been deferred until this control is gained. It is inadvisable to operate on children who are unable to attend to their clothing and the needs of nature. The best time for operation is between the ages of four or five and ten. Several of the patients not operated on were more than thirty-five years of age; they had contracted ureteral orifices, causing great dilation of the ureters and cystic kidneys.

The operative mortality is less than 20 per cent. This death-rate appears high, but when it is considered that these patients are relieved of a most distressing condition and that if left alone 75 per cent. of them would die before the age of thirty the operation seems warranted.

ILLUSTRATIVE CASES

CASE I (A93,590)—Miss M. D. aged thirty years, came to the Clinic October 11, 1913, because of complete exstrophy of the bladder. Both ureteral meati were visible and functioning. Only the lower portion of the labia was present. There was no umbilicus. Transplantation of the ureters by the Coffey method gave perfect relief. The patient has taken nurses' training since operation, and is now on active duty.

CASE II (A190,148)—Miss L. W. aged twenty-three years, was examined April 3, 1917. The exstrophied bladder was small, red, and granular, but not tender. The pubic symphysis was lacking. April 18th the right ureter was transplanted into

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A HUGE DIVERTICULUM OF THE BLADDER

VERNE C. HUNT

CASE A321,653 —Mr T S K aged sixty-six years, came to the Clinic June 26 1920 complaining of bladder trouble of four years duration and characterized by slowness in starting the urinary stream and low abdominal pain, at times very severe. There was no frequency and no gross blood or pus in the urine.

Examination revealed systolic blood-pressure 110 and diastolic 68 dental caries and sepsis a large doughy mass filling the lower abdomen to the level of the umbilicus apparently a huge distention of the urinary bladder and a moderate-sized right inguinal hernia. A small prostate was palpated by rectum which hardly seemed sufficient to account for the bladder distention 1500 c.c. of residual urine were withdrawn by catheter. The specific gravity was 1.019. There were 48 mg urea per 100 c.c. of blood, and 20 per cent. phenolsulphonephthalein output in two hours and fifteen minutes. The hemoglobin estimation was 70 per cent. A Wassermann reaction on the blood was negative.

Because of the huge distention of the bladder a cystoscopic examination or cystogram was not made, but diverticulum of the bladder was suspected and suprapubic drainage recommended. This was done without exploring the bladder. Three weeks later the phenolsulphonephthalein output had increased to 45 per cent in two hours and fifteen minutes, and the patient's general condition was good.

Cystoscopic examination at this time disclosed median bar enlargement of the prostate and great deformity of the right wall of the bladder from extravascular pressure and, although a diverticulum was suspected its opening could not be seen.

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DISCUSSION

The diagnosis of diverticulum its size a capacity of 1000 c.c., one of the largest, if not the largest, observed in the Clinic, and the effect of ligation of the ureter make this case of general interest.

The diagnosis of surgical lesions of the genito-urinary tract by cystoscopic examination and its allied methods in skilful hands approaches an exact science. It is due to accuracy of diagnosis that more diverticula of the bladder are now found than formerly. In 1918 Judd reported 44 cases in which operation had been performed in the preceding ten years. He emphasized the importance of exploring the bladder at the time of performing a prostatectomy in patients with marked cystitis and infection. Often diverticula are found when the bladder contains foul urine.

The diagnosis in this case was not established until operation. A cystogram was recommended before operation, but not made this method often demonstrates a diverticulum when cystoscopic examination fails to reveal the opening.

The disposal of the ureter in the excision of diverticula which include the ureter and in resections of the bladder for malignancy is not always easy to decide. A differential functional determination can usually not be made in these cases however with a good combined function and finding at operation a dilated thick walled ureter on the side of involvement, it is comparatively fair to assume that the ureter is partially if not completely obstructed, and that the opposite kidney is carrying on adequate function. In these cases probably little is to be gained by transplanting the ureter and usually it can be tied off and dropped back with safety. When this has been done, in the absence of infection in the corresponding kidney we have experienced no trouble, and a subsequent nephrectomy has not been necessary. However if a normal ureter is encountered which has not been obstructed, or if the function of the opposite kidney is in doubt, it is advisable to transplant the ureter into a new segment of the bladder or it may be possible to sacrifice only the vesical portion of the ureter with establishment of its lumen, as has been described by Lower. If a ureter is tied and

September 3 1920 the suprapubic sinus of the drainage operation was enlarged, and it was found that the suprapubic drainage tube had been placed in a diverticulum several times the size of the bladder with a capacity of at least 1000 c.c. The diverticulum originated from the right wall of the bladder in the neighborhood of the right ureteral orifice it was firmly fixed to the lateral and posterior pelvic walls and was removed only after the peritoneum had been opened. The right ureter was so closely incorporated in the diverticulum that it was cut and doubly ligated with silk at the pelvic brim, and dropped back rather than transplanted into a new segment of the bladder thus the left kidney was relied on entirely for future function. The prostate seemed of little significance and was not removed. The peritoneum was accurately closed as was the bladder. A urethral catheter was inserted and a tube was placed in the extravescical space for drainage.

Severe reaction followed the operation. There was only 525 c.c. urine output the first twenty-four hours, and at the end of forty-eight hours but 1700 c.c. of urine had been passed. The abdomen was greatly distended, the pulse was 150 and the patient's general condition was very poor all of which was explained on the basis of peritonitis and renal insufficiency. Under local anesthesia the abdomen was opened and tube drains were inserted for a low-grade peritonitis, and the distended pelvis of the right kidney whose ureter had been ligated was drained through the back. The patient's condition improved immediately and recovery was complete. The catheter was left in the pelvis of the right kidney for three weeks, at which time there was a return of 15 per cent. of phenolsulphonephthalein from the right kidney and 25 per cent. through the bladder from the left kidney in two hours and fifteen minutes. On removal of the catheter from the pelvis of the right kidney the urinary drainage from the kidney immediately ceased. Apparently atrophy of the right kidney occurred this obviated subsequent nephrectomy since all wounds healed. Cystoscopic examination six weeks after the operation showed urine entering the bladder only from the left kidney.

ADENOMYOMA PRESENTING AS A TUMOR OF THE BLADDER

E. STARR JUDG

THE patient, a single woman aged thirty four years whose occupation is housework and clerking in a store, was referred to me by Dr Priestley of Des Moines, Iowa. The patient complained chiefly of constant pain in the lower abdomen. The patient's father and mother are living and well, and there is no history in the family of malignancy or tuberculosis. Four years ago a pelvic tumor and her appendix were removed. She began to menstruate at the age of fourteen years and menstruated regularly until two years ago when a hysterectomy was performed. For four or five years she has had frequent and painful micturition, with straining and increased pain at the close of voiding. Formerly the pain was more severe during menstrual periods. She had headache, but no actual pain in the back, and intense pain in both sides, low down and throughout the pelvis. The pain had been more severe for about two weeks of each month. It radiated down the right leg and around the hip. She had obtained no relief from applications of heat, and had been obliged to take aspirin and other drugs prescribed by her home physician in order to endure the pain.

The patient was found to be nervous and thin, weighing 80 pounds. Her normal weight is about 105 pounds. Impaired resonance was noted at both apices, but without signs of activity. All of the uterus, except the cervix, had been removed. A mass not freely movable tender to bimanual pressure could be felt in the pelvis around the right fornix. Pain similar to that in the groin and leg could be brought on by pressure on this mass. The specific gravity of a twenty four-hour specimen of urine was 1.021. It was alkaline in reaction, and contained a small amount of albumin and a few pus-cells. The hemoglobin was

symptoms of renal insufficiency occur postoperatively the pelvis of the kidney may be opened to re-establish its function and the ureter transplanted later if necessary

In this case drainage of the pelvis of the kidney on the side of ligation carried the patient through until the single kidney was able to take over the entire load. It is of interest that a urinary fistula did not persist and require nephrectomy

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E. STARR JUDG

THE patient, a single woman aged thirty-four years, whose occupation is housework and clerking in a store, was referred to me by Dr Priestley of Des Moines, Iowa. The patient complained chiefly of constant pain in the lower abdomen. The patient's father and mother are living and well and there is no history in the family of malignancy or tuberculosis. Four years ago a pelvic tumor and her appendix were removed. She began to menstruate at the age of fourteen years and menstruated regularly until two years ago when a hysterectomy was performed. For four or five years she has had frequent and painful micturition, with straining and increased pain at the close of voiding. Formerly the pain was more severe during menstrual periods. She had backache but no actual pain in the back and intense pain in both sides low down and throughout the pelvis. The pain had been more severe for about two weeks of each month. It radiated down the right leg and around the hip. She had obtained no relief from applications of heat, and had been obliged to take aspirin and other drugs prescribed by her home physician in order to endure the pain.

The patient was found to be nervous and thin weighing 80 pounds. Her normal weight is about 105 pounds. Impaired resonance was noted at both apices, but without signs of activity. All of the uterus, except the cervix, had been removed. A mass not freely movable, tender to bimanual pressure could be felt in the pelvis around the right fornix. Pain similar to that in the groin and leg could be brought on by pressure on this mass. The specific gravity of a twenty four hour specimen of urine was 1.021 it was alkaline in reaction, and contained a small amount of albumin and a few pus-cells. The hemoglobin was

75 per cent. the erythrocyte count was 4,500,000 and the leukocyte count 9800. The systolic and diastolic blood pressures were normal. Roentgenograms of the kidneys, ureters, and bladder did not reveal evidence of disease. The cystoscopic examination revealed a tumor of the bladder about 4 cm. in diameter and involving the right side of the trigone, the right ureteral meatus, and a part of the right wall of the bladder. It extended practically to the urethral orifice. Dr. Brausch stated that the induration in the trigone extended across to the left meatus, but apparently did not interfere with it. The tumor seemed to be entirely covered with normal mucous membrane. There was no area of ulceration or necrosis and no evidence of papillary growths. A piece of the tumor was removed for microscopic study during the cystoscopic examination, but no evidence of a neoplasm was obtained, and the condition was reported to be inflammatory. A diagnosis of tumor of the bladder was made by Dr. Brausch, in spite of the fact that the usual history of hematuria which occurs in nearly all neoplasms of the bladder was not present. He stated in his report that the tumor was evidently secondary to a tumor of the right pelvis extending across the cul-de-sac. Because of the patient's increasing suffering it seemed best to operate with the hope of removing the growth even though there was considerable uncertainty about being able to do so.

November 19, 1919 I opened the abdomen in an endeavor to determine the nature and extent of the involvement. A fair sized low midline incision was made and the intestines were packed away from the pelvis after the surface of the liver had been palpated to be sure that it did not contain metastatic nodules. This exposure revealed a diffuse, infiltrating tumor in the right side of the pelvis involving the wall of the bladder and extending into the large muscles just inside the bony pelvis. The right ovary contained a cyst, and with the tube was attached firmly to the neoplasm. The tumor was more prominent within the bladder the mucous membrane of which was intact. The right ureter was dilated above the growth and disappeared into it. The left ureter came close to the growth, but whether or

not it was involved could not be determined. While it appeared that considerable dissection would be required in order to remove the growth, it was nevertheless evident that removal could be accomplished with a fair prospect for future relief provided the growth was not malignant. Removal of the tumor would necessitate the resection of so much of the lower end of the right ureter that reimplantation into the bladder would be impossible. Experience has taught me that it is best to ligate the cut-off ureter with permanent ligature and, should it become necessary to remove the involved kidney. This seems a better plan than to transplant the ureter into the colon or to remove the kidney at this time. In the case presented the right ureter had probably been closed for some time and as a result the kidney had ceased to function. The cystoscopic examination showed that the growth was involving the ureter and no urine was coming down from the right side. I have not known serious trouble to result from ligating the ureter at time of resecting the bladder for neoplasms if it had been determined that the ureter and kidney on the opposite side were normal. Undoubtedly in many extensive pelvic operations in the past the ureter has been ligated, and has not produced sufficient symptoms to cause it to become known.

With the tumor I removed the lower 10 cm. of the right ureter about one half of the right wall of the bladder and a part of the trigone, carrying the resection down to the ureteral orifice. I was careful to preserve all the sphincter muscle at this point. It was also necessary to remove the right ovary because of its attachment to the tumor and some of the muscles on the side of the pelvis. Even if I had been certain at this time that the condition was not malignant I do not believe that it would have been possible to remove the tumor and save any of the structures.

The sigmoid was attached to the tumor and in separating it a small opening was made this was readily repaired. The bladder was reconstructed and closed completely. Drainage was established by retention catheter through the urethra. Two small Penrose drains were placed in the abdominal wound.

The reaction following the operation was not more than might be expected. The pulse-rate reached 120 the first night, then gradually decreased and in a few days was normal and remained so. There was a serous discharge from the wound and after a number of days urine began to escape. The retention catheter was replaced and drainage ceased. The wound in the bladder closed and remained healed. At the end of six weeks the patient was dismissed from the hospital her wound was entirely healed, and she was voiding normally although frequently. A recent report states that her frequency has subsided entirely and her bladder functions normally. She is perfectly well and is working.

DISCUSSION

This case presents many problems. It was necessary to ligate the right ureter in order to remove the tumor and yet



Fig. 519.—(Case 296,495.) Cross-section of adenomyoma of the bladder—*a*, Small cystic areas filled with dark brown pigment in close proximity to *b*) epithelium of the bladder.

two years have elapsed since the operation, with no signs of trouble from completely closing off the kidney. Another interesting feature is that the patient had a normally functioning

bladder in a comparatively short time even though it was necessary to remove considerable of the wall including a part of the trigone.

Figures 519-524 show the nature of the neoplasm. The tumor an adenomyoma in the wall of the bladder was about 8 cm. in diameter a smaller growth, apparently a separate adenomyoma, was in the fallopian tube. It was impossible to



Fig. 520.—(Case 296,495.) Probe inserted into the right ureter through the meatus, both surrounded by tumor tissue. Note epithelium of the bladder at

determine the exact point of origin of this tumor as the patient had had two pelvic operations elsewhere and the uterus had been removed. Whether the tumor had any connection with the uterus or whether it was of the nature of those arising in the rectovaginal septum could not be determined. Evidently it is completely eradicated, since the patient has now been free from symptoms for two years.

The controversy as to whether these tumors originate from



Fig. 521.—Section through the adenocarcinoma. Typical endometrium between bundles of smooth muscle of the wall of the bladder ($\times 50$).



Fig. 522.—Higher magnification of section shown in Fig. 521 ($\times 100$).

structures coming from the wolffian duct or from those coming from the müllerian duct is not settled to the satisfaction of all. Cullen says that the mucous membrane cells in adenomas are always connected with the mucous membrane of the uterine cavity. Adenomyomas occurring in the round ligament or elsewhere have all the characteristics of those in the uterus.

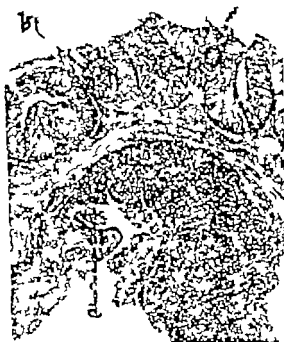


Fig. 523.—Section through adenomyoma of the bladder. Illustrating relation of (a) adenomatous tissue to (b) bladder epithelium.

Some observers contend that in the embryo a portion of the wolffian duct is nipped off and is the origin of the adenomyoma. Others contend that the tumors arise from the müllerian duct, since the mucosa lining them is in every way like the mucosa lining the uterus, and further that during menses this mucosa also becomes active so that after menses the adenomyomas of the round ligaments and elsewhere contain blood. Cullen in

1911 reported 9 cases of tumor of the umbilicus that proved to be adenomyomas. He says that undoubtedly 4 of these originated from Müller's duct, which gives rise to the uterine mucosa. Adenomyomas in the rectovaginal septum, he says, must originate from Müller's duct. In the case reported here the adenomyoma occurred in the bladder and it is possible that



Fig. 524.—Adenomyoma of the right tube. The glandular tissue is surrounded by smooth muscle of the tube.

the tumor which I removed was recurring or that a part of the tumor had been removed, and that I removed the extension from it. This growth was much more apparent in the inside of the bladder than it was elsewhere, but the extra-vesical portion might have been removed previously. This is the only case of the kind we have seen in operating on a large number of cases of tumor of the bladder.

PROGNOSIS IN CASES OF CARCINOMA OF THE PROSTATE DISCOVERED AT OPERATION

E. STARR JUDT HERMON C. BUMPUS JR. AND ALBERT J. SCHOLL, JR.

With the advent of radium as a therapeutic agent in the treatment of carcinoma of the prostate the surgical removal of the gland was generally abandoned. However careful microscopic examination of prostates, removed presumably because of benign hypertrophy occasionally reveals areas of malignancy. Malignant areas are more easily discovered in fresh specimens since the tissues pucker and draw producing a stellate point. Such areas are usually found in the posterior lobe, but occasionally they are discovered in the lateral lobes also they are generally very small.

Carcinoma of the prostate discovered at operation is one of three types that are treated surgically (1) The carcinomatous changes which although undoubted are deemed sufficiently early to warrant an attempt at surgical removal, (2) suspected carcinomas in which a positive diagnosis is not possible, and (3) the type discovered at operation. It would naturally be supposed that the prognosis in the last type would be the best, and in the first type the poorest. In an endeavor to confirm this point we made the investigation herewith reported.

Many of the patients studied were very old and had lived their natural lives, but they were suffering so much from their prostatic trouble that it seemed only right to attempt to relieve them, even with the possibility that they would not live very long. Many of them had infections that had extended into the kidneys, and while such conditions might be relieved by the operation the risk was increased and the probability of many years of life was diminished. The greater number of these patients who lived two years or less following operation died

from cardiovascular and carborenal diseases which are common in men of this age. In spite of this one must feel that the patients were well repaid for the operation on the prostatic neoplasm by the great relief from their bladder symptoms. While the lives of these patients were prolonged for a considerable length of time, the patients did not live long enough to fall into the group cured of cancer for three years.

In making a prognosis in cases of carcinoma of the prostate it must be borne in mind that many symptomless patients have been kept under observation for years while the malignancy was making slow progress. In several instances we have known carcinomas of the prostate, clinically diagnosed, to exist for from seven to ten years with very little evidence of the progress of the disease.

Radical operations which include the removal of the sphincter controlling the stream of urine have not been satisfactory in our experience. We believe it is necessary to preserve the sphincter control of the urine and as the disease nearly always involves the tissues of the posterior lobe it is practically impossible completely to remove it without destroying this function. For this reason particularly we hoped that radium would accomplish in these cases what it has, for instance in cases of carcinoma of the cervix. At first this seemed probable but a later review of results was disappointing, and we now believe it will be best to resume the operation of partial prostatectomy thus removing all the part except that which involves the controlling mechanism, and then possibly applying radium to this portion.

In order to determine whether or not the form of operation had any bearing on the final results, the patients were grouped according to whether the operation was suprapubic or perineal. Seventy-five patients were operated on by the suprapubic route, and 11 (14 per cent.) lived more than three years following operation. Forty-two patients were operated on by the perineal route and 5 (12 per cent.) have survived more than three years. Three years is not used arbitrarily as a unit of measure but because in studying a series of 231 untreated patients thirty-four and fifty-nine-hundredths months was

found to be the average duration of the disease, and obviously with any form of surgical or radium treatment, a considerable portion of the patients treated must live longer than three years to make the treatment of value.

STATISTICAL DATA

Sixty-six of the 77 patients in whom cancer was either diagnosed or suspected prior to operation have been traced. Of



Fig. 525—(Case 231975) Type 1 glandular carcinoma of the prostate ($\times 100$).

these, only 8 (12 per cent.) have lived more than three years, a result that indicates that if carcinoma of the prostate has progressed sufficiently to be recognized clinically surgery offers no more favorable result than radium.

Of still greater interest are the data obtained from the group

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Fig 525.—(Case 237,975) Type 1 glandular carcinoma of the prostate ($\times 100$)

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Of still greater interest are the data obtained from the group

of 62 patients in whom the malignancy was so obscure as to escape clinical detection, and was discovered only at operation or after careful examination of the gland microscopically. We have completed records of 51 of these patients, 8 of whom (15 per cent.) lived more than three years. Many of these patients have died from disease other than the prostatic car-



Fig. 526.—(Case 158,433) Type 1 glandular carcinoma of the prostate with moderate fibrosis ($\times 100$)

noma, but even so this percentage of three-year cures is low if the early stage at which the growth was removed is considered. It affords adequate testimony of the seriousness of the findings of cancer cells in an excised gland, and does not permit the assumption that because the growth was apparently small it has been removed completely.

From the foregoing it is apparent that neither the type of

operation nor the extent of the growth influences the prognosis in this class of patients. However when the cases are grouped according to the pathologic findings a marked difference in results is noted and we believe that the greatest factor in determining the prognosis of an individual case will not be the extent of the growth or the type of operation but rather the type of the growth removed.



Fig. 527 —(Case 178,863) Type 1 carcinoma of the prostate with extensive gland formation ($\times 100$)

Pathologically and clinically there are two types of prostatic cancers, with of course intermediate stages. The first is the more common type and its degree of malignancy is lower than that of the second type. The structure is made up of cells and glands and retains the normal or glandular structure (Figs. 525-526). The cells are partly differentiated, fairly regular in

size and shape, and retain the long tufted end projecting into the glandular lumen which is the most significant feature of prostatic epithelium. The nuclei are round, relatively larger than the nucleoli found in normal or hypertrophied glands, and contain the distinct nucleoli which are so prominent in undifferentiated cells (Figs. 527-529). Clinically these prostates are



Fig. 528.—(Case 314, F01.) Isolated area of small compact glands limited to the left lateral lobe of the prostate (X 50)

large, nodular stony and produce the symptoms of obstruction first calling attention to their presence. The second type of cancer is often confused with lymphocytic infiltration. The malignant cells that have migrated into the stroma often show a streaked or etched-out appearance in contrast to the clumped localized disposition of lymphocytic infiltration. The cells in such glands, either from morphologic or mechanical influences,

have lost their original structure they do not conform to the usual type, but vary in size and arrangement. These may compose great masses or extending wedges of tightly packed cells containing large deeply staining nuclei. In other cases the cells may be loosely arranged separated, and supported by a small amount of connective tissue. In prostatic carcinomas of Type

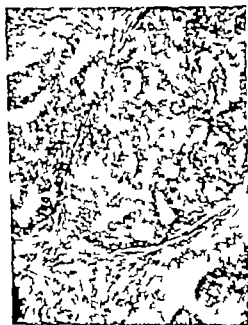


Fig. 529—(Case 14,261.) Type 1 carcinoma of the prostate, showing usual method of extension along the collecting tubules ($\times 100$)

2, in which there is an excess of fibrous tissue the cells may have disappeared completely or may be pressed into bizarre lines and streaks (Figs. 530-531). Often they are recognized only on account of the deeply staining nuclear fragments which persist. If there is glandular formation the acini are atypical and the cells are flat, grouped together irregularly and contain nuclei which are relatively much larger than those found in non-

malignant cells. Clinically the prostates of this type are small, fibrous and firmly fixed. They are extremely malignant, metastasize readily and are often unrecognized since paralysis may occur as a result of the metastasis before the glands have reached sufficient size to produce urinary symptoms. Their small size often leads to the erroneous opinion that the patients



Fig. 330—(Case 31,568) Type 2 carcinoma of the prostate. Marked fibrosis. Deeply stained malignant cells scattered through stroma with practically no gland formation ($\times 50$).

are good surgical risks and that operations with favorable results.

Of the 146 patients of our series in 100 it was possible to correlate the histologic findings with the postoperative course (Tables 1 and 2). Forty-four prostates were of Type 1 and 56 were of Type 2.

Eleven patients with prostatic cancers of Type 1 lived more

than three years. Twenty-two are still alive, 1 six years 2 five years, 4 four years, 3 three years, 6 two years, and 6 one year. Sixteen of the patients with prostatic cancers of Type 2 lived two years, 7 lived three years, and only 1 lived more than three years. Three patients are still alive, 1 three years and 2 one year after operation.



Fig. 531.—(Case 20,548) Type 2 carcinoma of the prostate with an almost solid mass of malignant cells and small amount of fibrous tissue ($\times 100$)

It seems evident, therefore, that in cases of cancer of the prostate the degree of malignancy as demonstrated microscopically determines the prognosis, and that when the disease has advanced sufficiently to be recognized clinically the possibility of surgical cure is diminished.

TABLE 1
146 PATIENTS OPERATED ON

	Pa- tients	Per cent.	Average age years.	Average length of disease, months.	Peritoneal procto- sectomy	Sigmo- plegic procto- sectomy	Average length of life after operation, months.
Traced	130	82.2	64.27	61.36	43	73 (3 not stated)	24.88
Dead	96	88.0	64.95	51.3	41	13	21.77
Living	24	30	63.54	88.2	1	23	38

66 Patients Dead

Lived from							
1 to 12 months	41	21.14	48	40	9	22	8.15
13 to 24 months	33	1	63.1	95	0	13	18.86
25 to 36 months	14	11.66	63.87	36.64	0		26.1
37 to 48 months	3	8.21	62	108	1	0	0
49 to 60 months	3		63	11	1	1	11.1
61 to 72 months		66	68	95	1	0	29.0
73 to 84 months		81	64	148.0	0		96
85 to 100 months		66	7	184.0			166.1
Not stated		0					

(3 not stated)

1 Patients Living

Lived from							
1 to 12 months	3	13	64.73	66.75			26.2
13 to 24 months		66	66.25	63		0	19.27
25 to 36 months		14		71		1	21
37 to 48 months	1	8.1	69	87			48
49 to 60 months	2	66	63	63			11.3
61 to 72 months		66	79	23	2		27
73 to 84 months		81	7	79	0		26
85 to 100 months		81		7			

TABLE 2

DIAGNOSIS BEFORE OPERATION IN 77 CASES

	Pa- tients	Per cent.	Average age years.	Average length of disease months	Peritoneal procto- sectomy	Sigmo- plegic procto- sectomy	Average length of life after operation, months.
Traced	66	85	64	50.37	22	44	2.88
Dead	66	90	64	48.79	22	26	2.36
Living		09	64	64.13			36.11

66 Patients Dead

Lived from							
1 to 12 months	34	36.36	64	33	1	1	66
13 to 24 months	36	34.54	64.0	49.62	1	1	64
25 to 36 months	3	3.1	67.1	63			11
37 to 48 months	3	8.1	66.3	79.5			22
49 to 60 months	3	3.1	68.0	96.3	1	1	78
61 to 72 months	3	8.1	7	54	0	1	63
73 to 100 months		9.09					
Not stated							

6 Patients Living

Lived from							
1 to 12 months	1	1	66	79		1	21.6
13 to 24 months	1	14	67	63			67.3
25 to 36 months	1	8.1	79				

TABLE 3

63 CASES DISCOVERED AT OPERATION

	Pa- tients	Per cent.	Average age, years.	Average length of disease, months.	Partial prosta- tectomy	Radical prosta- tectomy	Average length of life after operation, months.
Treated	31	83	64.52	45.04	20	31	23.18
Dead	23	64	63.1	53.46	19	4	19
Living	18	33.2	63.27	37.6	1	17	33.14

33 Patients Dead

Living from							
1 to 12 months	17	33.3	66.47	44		9	13
13 to 24 months	7	13.72	63.4	36.16			7
25 to 36 months		11.76	61	30.66	5	1	30.33
37 to 48 months	1	96	62.0	166		0	41.6
49 to 60 months	1	1.96	62	73	1		49
61 to 96 months	1	96	64.	168.9		0	95.9

18 Patients Living

Living from							
1 to 12 months	3	5.26	63.66	79.3			9
13 to 24 months	3		63.8	71	0		18
25 to 36 months	3		1	7		5	8
37 to 48 months		96	60	0	0		48
49 to 60 months			63	83	0		82
71 to 84 months	1	96	73.0	139	0		78
109 to 120 months	1	96	6.9	17.9	1	0	120

TABLE 4

42 PERINEAL PROSTATECTOMIES¹

	Pa- tients	Per cent.	Average age, years	Average length of disease, months.	Average length of life after operation, months.
Treated	42	100	63.97	54.47	23.16
Dead	41	97	64	53.29	20
Living			61	174	120

4 Patients Dead

Living from						
1 to 12 months	19	45.23	65	41.4	5	
13 to 24 months	1	94	64.37	37.3	1	
25 to 36 months	1	94	66.73	60.12	39	
37 to 48 months		96	62.9	166.0		
49 to 60 months		96	62.9	73.9		
61 to 72 months		96	64.0	117.9		
73 to 96 months		96	64.0	168.9	68.0	
Not stated	78				96.0	

Patient Living

Living from					
108 to 120 months.	2	36	61.0	1	120

¹The type of operation performed on 3 patients was not recorded.

TABLE 5
75 SUPRAPUBIC PROSTATECTOMIES

	Pa- tients	Per cent	Average age, years	Average length of disease, months	Average length of life after operation, months
Treated	75	87.5	64.87	36.34	34.76
Dead	52	89.33	63.43	38.09	27.73
Living	23	36.66	63.69	32.94	34.51

52 Patients Dead

Lived from					
to 12 months	11	29.33	65.09	36.27	
13 to 24 months	15	30	62.66	36	19.33
25 to 36 months			70.83	32.6	15
37 to 48 months		66	66	29.5	36.5
49 to 60 months	1	33	1		72
61 to 72 months	2	66	72	156.6	163
Not stated		33			

23 Patients Living

Living from					
to 12 months	4	33	64.73	66.75	30.25
13 to 24 months	8	66	66.23	38.42	19.37
25 to 36 months		66		71	3
37 to 48 months		33	66	32	48
49 to 60 months		66	33	33	
61 to 72 months		66	39	33	67
to 84 months		33	73	139.6	79

TABLE 6
PATHOLOGIC CONDITION AND POSTOPERATIVE RESULTS IN
100 CASES

(44 cases of Type 1 56 cases of Type 2)

65 Patients Dead

Type prostatic cancer	Type prostatic cancer			22 (50 33 (74)	per cent of 44 ¹ per cent of 36 ²
Lived from	per	Per cent		per	Per cent
to 12 months				26	5.1
13 to 24 months				14	33
25 to 36 months					13
37 to 48 months					6
49 to 60 months					6
to 72 months					
	22	30		33	94

15 Patients Living

Type prostatic cancer	Type prostatic cancer			56 per cent of 44 ¹ per cent of 36 ²	
Lived from	per	Per cent		per	Per cent
to 12 months					
13 to 24 months					
25 to 36 months					
37 to 48 months					
49 to 60 months					
61 to 72 months					
	22	96			

¹The type of operation performed on patients was not recorded.

ILLUSTRATIVE CASES OF MALIGNANT TUMORS OF THE THYROID

LOUIS B. WILSON

THERE is a wide-spread belief that malignant tumors of the thyroid are of rare occurrence, when, in all probability they are actually of relatively frequent occurrence. Another erroneous impression is that they develop only in middle life and progress rapidly to a fatal termination, when, in reality many of them apparently start as adenomas in the third decade and progress very slowly. There is probably a higher percentage of error in the early diagnosis of malignant tumors of the thyroid than in the diagnosis of malignant tumors of any other organ of the body. This is partly due to the resemblance, in early cases of malignant processes in the gland to other conditions. It is also due to failure to follow up cases for sufficient periods of time to determine the final outcome and thus to check diagnoses. Owing in large measure, to the numerous errors in diagnosis and to the frequent failure of surgical treatment, there is an unfortunate lack of literature in English concerning malignant tumors of the thyroid which the subject would warrant.

I desire to present herewith a few cases illustrating some of the types easy to diagnose and a few others such as are more commonly missed. For a more general discussion of the subject the reader is referred to my articles published elsewhere.

CASE I (A62 923) —This patient was a man aged forty three years. He was examined January 9 1912. He had had a goiter since childhood but with no marked growth at any time until three weeks before examination, when he noticed a small hard nodule just above his old goiter. Within three days this nodule grew to the size of a hen's egg. Since then it had grown rapidly and from the left toward the right side.

On examination a tumor of the left lobe .5 by 11 cm. in diameter was found. It was a very hard fixed, smooth growth which had pushed the trachea far to the right. The boundaries of the tumor were not well defined. In addition, two small nodules, about 2 cm. in diameter were found on the left side. The patient's weight up to three weeks before examination was 160 pounds his weight at the time of examination was 139 pounds. His physician said that two or three weeks before examination he had been jaundiced, but, though still sallow the jaundice had disappeared. During the last ten days he had



Fig. 532.—Case I (A62,923) Small spindle-cell sarcoma of thyroid ($\times 100$)

had considerable pain from the gutter up the left side of the neck to the ear and some slight pain in the corresponding region on the right side. For three weeks he had had some distress in the epigastrium. He had a slight strangling cough with some dyspnea.

January 11, 1912, operation revealed tumor attached to the trachea and to the mediastinum. 130 gm. of tissue was removed.

Some areas of the tumor tissue (sarcoma) were composed almost entirely of small spindle-cells, shown in Fig. 532, and others of round and giant-cells, shown in Fig. 533.

The patient died at his home one month after operation, and no necropsy was obtained. The long previous history of goiter in this case with exceedingly rapid growth of the tumor for a brief period before death, the mixed type of cells and the rapid termination in death are all characteristic of sarcoma of the thyroid. From careful histologic studies of 19 cases of sarcoma of the thyroid which I have made however I am convinced that all of them can be best explained on the basis of a long persistent proliferating adenoma which for some reason

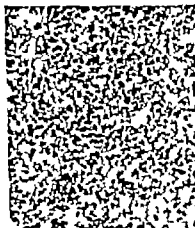


Fig. 533—Case I (A62,923) Round-nd giant-cell sarcoma. Another area from the same specimen as that shown in Fig. 532 ($\times 100$)

finally takes on exceedingly malignant characteristics with small round, spindle- or giant-cells making up the body of the tumor

CASE II (A82 471) —This patient was a woman aged fifty-six years, married. She was examined April 4 1913. She had had goiter for thirty years with rapid growth for one year associated with much loss of strength and some loss of weight. During the last seven months her trouble had been growing worse and she had had great dyspnea and cough.

Examination showed that her vocal cords were paralyzed. An emergency operation was performed April 9 1913 to relieve



Fig. 534.—Case II (A82,471.) Adenocarcinoma of thyroid, apparently evolved from proliferating adenoma ($\times 100$).



Fig. 535.—Case II (A82,471.) Adenocarcinoma of thyroid invading tracheal cartilage. From same specimen as that shown in Fig. 534 ($\times 100$).

the dyspnea. It was found that tumor of the thyroid had penetrated the trachea on the right side for about 3 cm. A small ball of tumor tissue projected entirely across the trachea and

fitted into a depression on the opposite side, thus almost completely shutting off air. The thyroid surrounding the trachea at this level was soft and degenerated. The patient died a few days after operation and necropsy did not reveal metastasis.

The general histologic character of the tumor is shown in Fig 534. Apparently it is an adenocarcinoma developing on a proliferating adenoma. The histology of that portion of the tumor which had invaded the trachea is shown in Fig 535.

In this case the origin of the tumor from a proliferating adenoma was strongly suggested. It should be noted that the rapidly fatal result in this case was apparently not due to a different type of tissue, but to the unfortunate circumstance of the tumor's being directed toward the trachea rather than away from it.

These cases illustrate two rapidly fatal types of thyroid tumors. While not rare they are by no means as frequent as the tumors which develop slowly and even if examined early microscopically they are not ordinarily recognized as malignant and are seldom followed up long enough by the clinician or to the necropsy table by the pathologist to determine their really malignant character. The following cases are illustrative of the much more numerous group of slowly developing tumors.

CASE III (A143 174) —This patient was a man aged forty-five years. He was examined October 12, 1915. He had had a tumor on the right side of his thyroid for three years, which had given occasional pressure symptoms. About six months before examination his breath began to grow short. During the past four months his weight had been reduced from 210 to 167 pounds. In the past three and a half months his general strength had been materially reduced.

A clinical diagnosis of substernal goiter was made. An exploratory operation was performed October 22, 1915, and 25 gm. of tissue was removed from the right lobe of the thyroid near the trachea. This tissue consisted of a small portion of thyroid and an adherent lymph-gland.

Figure 536 shows that the thyroid tissue consisted of a rather large celled adenocarcinoma. In the upper portion of the section



Fig. 536.—Case III (A143,174.) Large cell adenocarcinoma of thyroid showing papilla formation in upper portion. The lower portion is apparently development from proliferating denoma ($\times 100$).



Fig. 537.—Case III (A143,174.) Metastatic adenocarcinoma of thyroid into lymph-gland. From same specimen as has shown in Fig. 536. The tumor in this area is markedly papillomatous ($\times 100$).

some evidence is shown of papilla formation. Figure 537 a photograph of a section from the lymph-gland shows the markedly papillomatous type of the metastatic growth.

Seven months after operation the patient's physician reported that the patient was still living and at work, but that two large nodules had developed at the site of operation.

Eight months after the operation the patient returned for examination. The tumor had grown slowly and now extended up toward the right lobe. The patient's general condition was greatly improved. His weight had increased to 204 pounds. His breathing was easier and he had not had dysphagia. During the period he had had twenty-eight injection treatments of Coley's serum.

Three years and nine months after the first operation the patient was again examined by a very competent surgeon who reported to the Clinic: "I have just examined Mr. ———. At the present time he has quite a large growth with tracheal distress. The growth seems quite movable with the exception of the point of attachment to the trachea. If he had not been able to give a diagnosis of malignancy from such a good source I would rather have questioned it on account of the length of time which has elapsed and the general aspect of the patient."

And yet, in less than one month after this report, this patient died of carcinoma of the thyroid with diffuse metastasis to the lungs.

This is rather a typical instance of ordinary slow-growing adenocarcinoma of the thyroid. The age of the patient, the history of goiter for several years, the recent increase of growth, with local pressure symptoms and loss of weight, the temporary improvement under treatment, the prolonged course of the disease and the rapid downward course to death at the end, are all characteristic of the usual history of the adenocarcinomatous type of thyroid tumor.

CASE IV (A52 976) — This patient was a woman aged twenty-eight years married. She was examined May 12 1911. She had had goiter since childhood which had increased in growth during the last year. She had always been nervous, but had been growing more so during the last year. She had had no dyspnea.

Examination revealed a tumor of the right lobe of the thyroid 6 by 7.5 cm. in diameter and very much enlarged cervical glands

which she thought had been enlarged for five or six years. Her general strength was good. A clinical diagnosis of cystadenoma of the thyroid was made.

May 18 1911 the right lobe and isthmus of the thyroid, consisting of 135 gm. of tissue, were removed at operation. The



Fig. 538.—Case IV (A52,976.) Transverse section of tumor of right thyroid removed at first operation. The circular dark area—degenerating colloid adenoma. The surrounding light crescentic area is proliferating fetal adenoma (Wucherende Struma, Langhans) histologically resembling that shown in Fig. 540. A few rows at the base of demarcation between the two types of tumor and at the periphery of the tumor are seen a apparently rapidly proliferating and is papillary ones (Fig. 539) ($\times 100$).

gross appearance of the gland in transverse section is shown in Fig. 538.

The loose central portion was degenerating colloid adenoma. The more dense whitish crescentic mass was fetal adenoma.

with relatively small cells and large nuclei similar to that shown in Fig. 540. In some areas at the periphery of the nodule and in others near the line between the degenerated portion and the more solid portion the tissue appeared to be an actively growing papilloma, as shown in Fig. 539.

Notwithstanding the age of the patient, a diagnosis of early papillomatous carcinoma was made and roentgenographic treatment instituted.

The patient remained well until she bore 2 healthy children. The first child was born two years and the second four years and



Fig. 539—Case IV (A52,976.) Papillomatous adenocarcinoma of right thyroid, from areas described under Fig. 538 ($\times 100$)

nine months after her operation. In August, 1916 one month after the birth of her last child, the remaining thyroid tissue on the right side began to grow rapidly. She had no disturbance of breathing and no nervousness, but considerable pain in the lower back.

The patient returned to the Clinic November 24, 1916 and a slightly hard movable tumor 3 by 5 cm. in diameter was found.

November 30, 1916 26 gm. of tissue was removed partly from the right and partly from the left lobe of the thyroid.

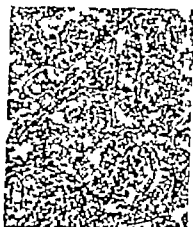


Fig. 540.—Case IV (A52,976.) Proliferating adenoma (carcinomatous?) of thyroid; from left lobe of thyroid specimen removed five and one-half years after first operation on right lobe ($\times 200$).



Fig. 541.—Case IV (A52,976.) Papillomatous adenocarcinoma of right thyroid removed from same patient five and one-half years after first operation. Upper portion of figure shows same type of tumor as the one shown in Fig. 539 (from first operation). Lower portion shows colloid goiter.

The character of the tissue from the left lobe is shown in Fig. 540. It is proliferating fetal adenoma like that con-

stituting the larger portion of the more solid areas removed at the first operation (Fig 538). The tissue from the right side consisted of a small lymph-gland in immediate contact with a portion of the thyroid. The lymph-gland contained metastatic carcinoma (upper portion of Fig 541) while the thyroid in immediate juxtaposition thereto was colloid goiter (lower portion of Fig 541).

The patient died two weeks after her last operation. At necropsy the lungs were found filled with small metastatic



Fig 542—Case IV (A52,976) Papillomatous adenocarcinoma of thyroid metastasizing to lung five and one-half years after first operation. Note resemblance to tissue shown in Fig 539 removed at first operation ($\times 100$)

nodules. The tissue in the larger of these, some of which were 5 mm. in diameter microscopically (Fig 542) was almost exactly like that found in the thyroid at the first operation five and a half years before (Fig 539). The edge of a small nodule about 2.5 mm in diameter with a bit of its surrounding lung tissue is shown in Fig 543.

This patient's age (twenty-eight years) her nervousness and the presence of a thyroid tumor might have led a careless observer at the time of her first examination to a diagnosis of exophthalmic goiter and indeed it may be that the papillo-



Fig 540.—Case IV (A52,976) Proliferating adenoma (cardioma) of thyroid from left lobe of thyroid specimen removed five and one-half years after first operation on right lobe ($\times 200$)



Fig 541.—Case IV (A52,976) Papillomatous adenocarcinoma of right thyroid removed from same patient five and one-half years after first operation. Upper portion of figure shows same type of tumor as that shown in Fig 539 (from first operation). Lower portion shows colloid goiter

The character of the tissue from the left lobe is shown in Fig 540. It is proliferating fetal denoma like that con-

cm. in diameter was found. There was a slight bruit, but no thrill. The larynx was pushed to the left. A clinical diagnosis of cystadenoma of the thyroid was made.

December 8, 1910, a proliferating fetal adenoma weighing 270 gm. was enucleated from the left lobe of the thyroid.

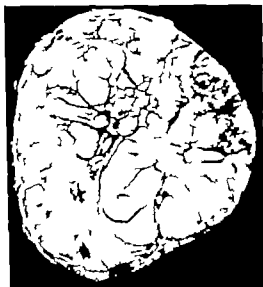


Fig. 544.—Case V (A42,543). Transverse section of proliferating fetal adenoma of left thyroid removed at first operation. The dark colored tissue in the lower left portion of the section is of ordinary colloid type. The lighter colored tissue in the upper right portion of the section is typical proliferating adenoma ("wuchernde Struma," Langhans). The histologic characteristics of the tissue in this area are shown in Fig. 545 ($\times 8$).

The gross appearance is shown in Fig. 544. The histologic appearance of the more solid (whitish) portions of the tumor is shown in Fig. 545.

This patient remained well after his operation for nearly five years, when a small nodule appeared over the middle of the thyroid. This nodule gradually enlarged without causing symptoms. Three and one half years later, or about eight and one half years after his first operation, he noticed a small firm mass

matous overgrowth of thyroid tissue may have had something to do with her nervousness, but she had no other symptoms of exophthalmic goiter. These same factors and her return to health for almost five years after her first operation made the initial pathologic diagnosis of early carcinoma seem absurd during that time. The case illustrates the importance of thoroughly examining all portions of removed thyroid tissue and of following up all suspicious cases for long periods of time even when reports from patients and physicians continue most



Fig. 343. —Case IV (A52,976.) Papillomatous adenocarcinoma in small metastatic nodule in the lung. Note resemblance in upper right-hand corner of this section to the tissue shown in Fig. 340 (from left thyroid) and in upper left-hand corner to tissue shown in Fig. 339 (from right thyroid) ($\times 100$)

favorable. The surgical and roentgenographic treatment may have been considerable factors in the prolongation of this patient's life.

CASE V (A42,843) —This patient was a man aged sixty-one years, and married. He was examined September 5 1910. He had had goiter for twelve years, with gradual enlargement, but without symptoms other than slight pains and weakness recently.

On examination, left-sided, somewhat hard goiter 8 by 8

swelling in the location where the goiter was. These symptoms no doubt indicate serious local recurrence.

In this case more than nine years elapsed after the first operation before the return of the tumor caused the patient again to consult a physician. In the meantime the character of the tumor had not materially changed histologically but it had slowly infiltrated surrounding tissues. It will no doubt soon result in the death of the patient.

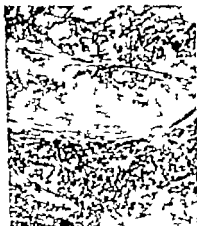


Fig. 546—Case V (A42,843) Adenocarcinoma infiltrating tissues of neck from same patient as specimens shown in Figs. 544-545, but removed nine years and two months after removal of specimen shown in these figures. Note the close resemblance of this tissue to that shown in Fig. 545 ($\times 100$)

Of the 290 patients with malignant tumors of the thyroid who were examined in the Mayo Clinic from January 1 1901 to January 1 1921 158 had certainly developed goiter before they were thirty years of age. Only 61 of the patients had not noticed any thyroid enlargement previous to one year before the diagnosis of malignancy was made. This long persistence of tumors of the thyroid before malignancy is demonstrated is one of the chief causes of error in diagnosis. So far as the actual clinical evidences of malignancy are concerned, only about one-fourth of the 290 patients had noticed symptoms of mark

over the upper sternum below the level of the clavicle, but without connection to the tumor above. This mass enlarged very slowly without tenderness and with only occasional darting pain. After a few months a small amount of bloody material was discharged from the lower portion of the mass. The wound closed under home treatment, but the patient returned to the Clinic for examination February 14 1920, nine years and two months after his first operation.



Fig. 545.—Case 1 (A42,843.) Proliferating "folial adenoma" ("tracheo-renal Struma," Langerhans) from light colored area shown in Fig. 544 (X 100)

February 20 1920 a tumor about 6 by 8 cm. in diameter attached to the sternum and one about 2 by 2 cm. in diameter attached to the trachea together with a considerable amount of surrounding tissue were removed, the total weight of tissue being 280 gm.

Microscopic examination showed extensive local infiltration of the surrounding tissues by an adenocarcinoma of the thyroid. The character of the infiltrating growth is shown in Fig. 546.

July 6 1921 the patient's physician reported that the patient "was suffering from considerable soreness pain and a hard

CLINIC OF DR. WILLIAM J MAYO

SPLENIC SYNDROMES

MANY diseases have been named on the basis of a purely symptomatic syndrome, the names being merely convenient hooks on which to hang a miscellaneous assortment of obscure conditions. The absence of definite etiology and pathology however is somewhat compensated for by a rather definite symptomatology which gives an appearance of reality to obscurity. For many reasons disease syndromes of the spleen have been most remarkable in this respect. The spleen is an organ whose removal in health causes no profound or permanent change in the human economy whose function, such as it may be, is readily taken over by other organs or tissues, and whose diseases are capable, directly or indirectly of producing most serious constitutional changes which may lead to death.

A survey of these so-called splenic syndromes should not be too closely concerned with the details, but it should rather be an attempt to obtain a perspective of the phenomena as a whole. The most interesting of the splenic syndromes are those which concern the blood. The blood may be looked on as tissue in the form of fluid instead of a connective-tissue medium, its function being to carry oxygen and food to the tissues, to remove from them the ash and waste products, and in addition, to carry noxious agents of all sorts which may gain entrance to the blood, to the kidneys, mucous membrane and skin for elimination, or to the vital laboratories, of which the liver is chief for defense. The spleen considered from this broader conception, is concerned with the purification of the blood, and is one of the agents whereby worn-out red blood-cells and infectious or toxic material of various kinds are filtered from the blood-stream and directed to the liver the great metabolic and detoxicating organ of the

edly accelerated thyroid growth for one year or less. About one-third had noticed symptoms of continuous growth for ten years or more. Thus, while a sudden increase in rate of growth of a long-standing nodular tumor of the thyroid in a patient more than thirty-five years of age is strongly indicative of beginning malignancy a slow continuous growth of a nodular tumor may be almost equally indicative of the same condition.

The more one studies the pathology of tumors of the thyroid, the more he is led to believe that they all have their origin in proliferating "fetal adenomas" ("wucherende Struma of Langhans). All other types of the different histologic structures are theoretically derivable from this type. In many instances the histologic changes can be traced step by step in different portions of the same tumor and in different tumors removed from the same patient at different times. This hypothesis would go far toward explaining the slow development of most thyroid tumors.

It is most important that the clinician and the pathologist should remember that all nodular tumors of the thyroid when removed should be carefully examined histologically in every portion. If markedly proliferating adenomatous tissue is found the tumor should be considered potentially malignant. The prognosis should depend aside from the general condition of the patient, on the relative preponderance of degenerative and regenerative processes in the tumor. And finally all patients from whom nodular tumors of the thyroid have been removed should be kept under observation, if necessary for at least ten years, until the true character of any subsequently developing tumor has been determined clinically and pathologically.

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spleen reaching to the level of the umbilicus. The urine contained an occasional pus-cell. Roentgenograms of the chest and stomach were negative. The Wassermann reaction on the blood and an examination of the spinal fluid were negative. The blood findings are given in Table 1. A provisional diagnosis was made of splenic anemia.

March 24th the patient was splenectomized. The spleen was found to be about three times normal size, very adherent, and much creased on the surface. The liver was moderately

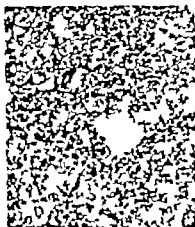


FIG. 547.—(Case 352,499.) Splenic anemia, chronic cirrhosis of liver with beginning trophy of cells ($\times 100$)

cirrhotic. A specimen was removed for microscopic diagnosis (Fig. 547). In removing the spleen considerable hemorrhage occurred, and it was necessary to leave a gauze pack in the wound, the end of which was brought out through a stab wound between the twelfth rib and the anterior superior spine of the ilium. The pack was removed in forty-eight hours. The convalescence was characterized by increased temperature for twenty-one days and pain in the splenic area. The patient was dismissed after thirty-one days. He has steadily improved and has returned to his occupation.

body. In other words, the function of the spleen and the pathologic misfortunes which it sponsors concern chiefly the bloodstream. It would appear that the spleen is not the principal agent, but that it is rather an agent of destruction through which the damage is brought about.

Always it is our desire to place our hands definitely on a certain organ and say "Here is the trouble," but indefiniteness lurks around the spleen. Even when splenectomy results in alleviation of symptoms, or in cure, we are by no means convinced that the spleen was the cause of the ailment. We are only sure that by removing it we have eliminated an organ of destruction or perhaps broken a vicious circle. It is my purpose at this time to speak of five syndromes in which the spleen may play a *prima donna* rôle. Four of these—splenic anemia, pernicious anemia, hemolytic icterus, and polycythemia—concern the erythrocytes, and one—splenomyelogenous leukemia—concerns the leukocytes.

Within a brief period I have splenectomized 10 patients because of syndromes connected with the pathology of the blood: 4 had splenic anemia, 1 pernicious anemia, 2 hemolytic icterus, 1 splenic polycythemia, and 3 splenomyelogenous leukemia. The histories of 6 of the 10 patients have been selected to illustrate the five conditions.

SPLENIC ANEMIA

CASE I (A352499).—Mr. F. B., aged forty-seven years, came to the Clinic March 15, 1921, complaining of pain in the epigastrium. Six months before he had suffered from a feeling of fulness in the epigastrium immediately after meals, which had subsided as time for the next meal approached. During the last ten days he had had a dull aching pain in the epigastrium when the stomach was empty; food in the stomach had relieved the pain. There had been no symptoms of dyspepsia, no nausea, or vomiting. He had lost 8 pounds in weight during the last few months.

Examination revealed palpable lymph-nodes in the cervical region, prominent veins in the epigastrium, and an enlarged

found to be enlarged thorough treatment for syphilis elsewhere somewhat reduced the size of the liver

Examination revealed marked abdominal ascites and edema of both legs the spleen extended to the level of the umbilicus. The Wassermann reaction on the blood was strongly positive. A diagnosis was made of syphilitic hepatitis with splenomegaly. The blood findings are given in Table 2



Fig. 548.—(Case 166,956.) Syphilitic splenic anemias; fibrosis and perisplenitis; weight of spleen 950 gm.

August 11th operation was performed. The liver was markedly cirrhotic nodular and about one-half the normal size. The spleen, which weighed 950 gm. and was gorged with venous blood was removed (Figs 548-550). About 12 liters of fluid were drained from the abdomen. The convalescence was stormy and two blood transfusions were necessary.

September 25th the patient died. Necropsy revealed thrombosis of the portal vein, fat necrosis of the pancreas, and syphilitic cirrhosis of the liver with ascites.

TABLE 1
BLOOD FINDINGS
(CASE A352,499)

Det.	3/15/21	3/24/21	5/3/21	5/27/21	9/29/21
Hemoglobin, per cent	72.0		63.0	70.0	65.0
Erythrocytes, millions	4.4		4.34	4.62	4.29
Leukocytes	5800		10,600	11,600	9980
Polymuclears, per cent	82.0	plasmacytosis		52.0	normal
Small lymphocytes, per cent.	11.5			32.5	
Large lymphocytes, per cent.	4.5			9.0	convalescence
Eosinophils, per cent.	2.0			4.5	
Basophils, per cent.				1.5	

Comment.—This patient was in poor condition he was anemic, and tired easily. He had been compelled to take a prolonged vacation but was not benefited. The first month after the splenectomy he did not show much improvement, the leukocytes increased and the anemia continued. He then began to improve, and in three months had reached his former vigor. Six months after operation he was examined and found to be normal in every respect. He felt better than he had for years and was able to carry on his important work.

SYPHILITIC SPLENIC ANEMIA

CASE II (A366,956).—Mrs. H. M., housewife aged thirty nine years, came to the Clinic August 2, 1921 because of an enlarged abdomen. Her mother had died of cancer of the liver. The patient had been married fifteen years she had had one miscarriage, but no children. She had had diphtheria, scarlatina, influenza, pneumonia, pleurisy, malaria, syphilis, and gonorrhea. At the age of sixteen sores appeared around the vulva. At the age of twenty five the throat was ulcerated for four months. In 1919 she had noticed that her abdomen was gradually increasing in size and that the lower extremities were markedly edematous. A positive Wassermann reaction on the blood had been discovered by her home physician and the liver

TABLE 2
BLOOD FINDINGS
(CASE A366,956)

Date	8/2/21	8/3/21	8/11/21	8/24/21	9/19/21	9/25/21
Hemoglobin, per cent.	62.0	64.0				
Erythrocytes, millions	4.0	3.94				
Leukocytes	3800	3800			21,700	
Polynuclears, per cent.		79.0				
Small lymphocytes, per cent.		18.0				
Large lymphocytes, per cent.		2.0				
Eosinophils, per cent.		1.0				

Splenectomy

Transfusion 500 c.c.

Patient died—syphilitic cirrhosis of the liver

Comment.—This case illustrates the syphilitic type of splenic anemia in its terminal stage. The patient had been treated vigorously for two years for syphilis; one course of six treatments of salvarsan had been given recently. She was slightly icteric, greatly emaciated, edematous in the lower extremities, and ascitic to such an extent that she was unable to walk without assistance. At the time she was operated on her general condition was so poor that a bed-sore was beginning to form on the buttock. The patient was mentally remarkably vigorous. She urged strongly her right to a chance. It was agreed that the abdomen should be explored, and if the spleen could be removed without risk of death on the table, it should be done. Under local and ether anesthesia the abdomen was opened in the middle line. 12 liters of fluid were evacuated and the spleen removed. The liver was remarkably cirrhotic and was about 4 by 15 by 25 cm. The convalescence was stormy but the patient improved greatly and was able to leave the hospital at the end of thirty days. Improvement continued until a few days before her death, when she suddenly developed dyspnea, which passed into coma.



Fig. 519.—(Case 366,956.) Extensive fibrosis with almost complete destruction of splenic pulp; one small area of practically normal splenic tissue ($\times 50$).

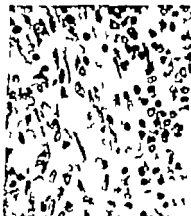


Fig. 520.—(Case 366,956.) Many fibroblasts and few lymphocytes ($\times 500$).

TABLE 3
BLOOD FINDINGS
(Case 43) (53)

[illegible]

PERNICIOUS ANEMIA

CASE III (A351 155).—Mr C. G. a farmer aged thirty-nine years, came to the Clinic March 2, 1921 because of weakness. Appendectomy had been performed in 1912 and he had had influenza in 1918. Since 1911 he had been conscious of a vague distress in the epigastrium associated with belching. His tongue had been sore at intervals for four years. In the spring of 1920 he had begun to lose color and to feel weak; the hemoglobin had been 38 per cent. A transfusion had relieved the symptoms for a time but in November they returned, and two transfusions did not relieve him. The fingers and toes occasionally had been numb and tingled. He had palpitation and dyspnea, and had lost 7 pounds in weight.

The skin was yellow. The spleen could be palpated 3 cm. below the costal margin. The tongue was bald. Achlorhydria was present and a Roentgen-ray examination of the stomach was negative. The Wassermann reaction on the blood was negative. The stools were negative for parasites. On neurologic examination there was evidence of early combined sclerosis. The blood findings are recorded in Table 3. The diagnosis was pernicious anemia. Splenectomy was decided on because of the patient's failure to improve after four transfusions.

April 9th operation was performed, and a large adherent spleen, dark in color resembling that of hemolytic icterus, and weighing 560 gm. was removed. A transfusion of 500 c.c. was given after the operation.

The patient was dismissed from the hospital April 20th and went home. He had many of the same symptoms as before the operation but he gained 20 pounds in weight and his blood count improved markedly. In June he again began to lose weight and became weak. August 11th, when he returned to the Clinic, the hemoglobin was 10 per cent. and the erythrocytes 750,000. Five transfusions have been given. The erythrocytes are now more than 2,000,000 despite an intercurrent bacillary dysentery.

was then palpable. She had had tonsillitis and rheumatic fever. Since 1917 she had had attacks of severe pain which lasted for from a few hours to several days and were accompanied by nausea and vomiting and followed by jaundice and dark colored urine. The pain began in the left hypochondrium, but it shifted quickly to the epigastrium. The attacks had occurred two or three times a year but during the three weeks previous to examination she had had an attack every three or four days, during which the pain had been so severe that morphin had been required. Her physician had diagnosed the mass in the upper left abdomen an enlarged spleen.

Examination revealed the patient to be poorly developed somewhat dyspnoic, and deeply jaundiced. The spleen was low extended into the left iliac fossa, and beyond the umbilicus. It was easily palpable. The systolic blood-pressure was 92 the diastolic 58. Two examinations of the urine showed no bile. The roentgenogram of the stomach was negative. The Wassermann reaction on the blood was negative. The blood findings are recorded in Table 4. The color-index, it will be noted, was high, but the blood-smears did not show the characteristics of pernicious anemia and the reticulated cells were numerous. The fragility of the erythrocytes in circulation was increased. The examination of the duodenal contents revealed 24 000 units of urobilinogen and urobilin. A diagnosis was made of hemolytic jaundice and gall-stones.

July 9th operation was performed. The spleen was found to be enlarged to about three times normal size (775 gm.) and showed the usual dark color of hemolytic icterus. The gall bladder was distended with stones. There was considerable bloody serum in the abdominal cavity. The spleen, the gall bladder the left fallopian tube, which contained a ruptured extra-uterine pregnancy about 9 cm. in diameter were removed.

The convalescence was uneventful.

Comment.—It will be noted that a large adherent spleen was removed, and that seven transfusions of blood were given following operation. The patient gained 20 pounds in weight in two months and then he gradually became worse. He returned to the Clinic and was given five transfusions. He is still under treatment.

Giffin and Salapka traced 50 patients who had been splenectomized in the Clinic for pernicious anemia four years before and found that 21.3 per cent. lived more than three years after operation, and 10.6 per cent. more than five years. These splenectomized patients lived on an average two and one-half times as long as a comparable group of non-splenectomized patients with pernicious anemia. It would seem that the spleen was not the cause of the pernicious anemia, but rather an agent of destruction—that the formation of erythrocytes was defective and as one of the functions of the spleen is the destruction of worn-out corpuscles, these subnormal corpuscles, the best the patients could produce, were unnecessarily sacrificed. The removal of the spleen checked the unnecessary destruction of blood. Three deaths occurred in the first 19 cases of splenectomy for pernicious anemia in the Clinic. These patients were operated on during crises and while they were on the down-grade. All the patients operated on since that time (39) have recovered from the operation. Splenectomy should be done while the patient is on the up-grade such as following blood transfusion.

HEMOLYTIC ICTERUS

CASE IV (A363,148)—Mrs. F. S. aged thirty-five years, came to the Clinic June 29, 1921. She was jaundiced and complained of having had for years a dull, aching pain in the left side which was enlarged. She had been married seventeen years and had had 4 children, all of whom were living and well. Her menstrual periods had begun at the age of seventeen and were normal. She had had slight flow before and after the last period, which was one week before examination. On careful questioning it was learned that since 1916 she had had constant slight jaundice. Her family physician believed that her spleen

ment of the perisplenic veins and the mesenteric vessels had been found. One week later the hemoglobin had been 106 per cent, the erythrocytes had numbered 9 000 000. *Endameba histolytica* had been found in the stools and the patient had received treatment for this condition. Pain had reappeared in the epigastrium.

On examination the patient was markedly erythrotic. The spleen extended almost to the level of the umbilicus and the midline. The urine contained an occasional pus-cell. The Wassermann reaction on the blood was negative. The eye



Fig. 551 —(Case 253 491.) Primary polycythemia peribiliary and perivascular cirrhosis of the liver with lymphocytic infiltration ($\times 100$)

grounds showed slight venous engorgement and hyperemia of the nerve head. The fragility test of the erythrocytes was normal. The blood findings are given in Table 5. The hemoglobin estimations were made by the Dare method, and would be higher if the acid hematin method had been employed. Diagnosis of primary polycythemia with chronic septic splenomegaly was made.

The patient was dismissed from the Clinic, but he returned several times for observation. February 14 1919 a severe hemorrhage from the stomach occurred. In October 1920 a small

TABLE 4
BLOOD FINDINGS
(CASE A363,148)

Da c.	6/29/21	7/1/21	7/9/21
Hemoglobin, per cent.	63.0	63.0	
Erythrocytes, millions	3.12	3.5	
Color-index.	1.0	0.9	
Leukocytes	8800		
Polynuclears, per cent.	83.0		
Lymphocytes, per cent.	13.5		
Mononuclears, per cent.	3.0		
Eosinophils, per cent.	0.5		
Anisocytosis	Slight		
Poikilocytosis	Slight		

Splenectomy
Convalescence uneventful.

Comment.—Splenectomy for hemolytic icterus is one of the triumphs of modern surgery. Patients who perhaps, have been jaundiced for an entire lifetime within four days become free from the jaundice and there is rapid improvement in the anemia. In 30 cases there has been but one death and this was a patient who was operated on during a crisis, when the temperature was 102° F. the jaundice was increased, and there was marked tenderness over the spleen and the liver. Patients should not be operated on during a crisis.

PRIMARY POLYCYTHEMIA

CASE V (A253491).—Mr. O. L. P., aged thirty-one years, registered in the Clinic December 13, 1918. He had had bronchopneumonia, tonsillitis for which tonsillectomy had been performed in 1915, rheumatic fever, bilious attacks since childhood, and in 1908 a severe attack of jaundice. In June, two hours after meals, he had had attacks of rigidity with epigastric pain, which had lasted one hour. The pain had been accompanied by diarrhea, but no vomiting or fever. The attacks had persisted for one week. August 26th epigastric pain had been so severe that morphin was required for relief. The abdomen had been greatly distended, the leukocytes had numbered 25,000. A diagnosis of perforating gastric ulcer had been made. On abdominal exploration elsewhere an enlarged spleen with engorge-

tion was very severe the spleen as well as the erythrocytes was considerably reduced as a result. At the time of the operation the blood count showed that he had gained considerably. Careful examination of the abdomen during the operation did not reveal a lesion other than of the spleen. A specimen removed was negative except for mild hepatitis.

It has been believed that the enlargement of the spleen in polycythemia has no particular significance, for when the patients die terminal pathologic conditions are found in other organs. But this case, while it does not permit generalizations, leads us to suspect that the spleen plays a much greater part in the disease than has been credited to it, and that early in its course the conditions found in the other organs at necropsy do not exist. One may well believe that the adult function of the spleen in destroying erythrocytes is much reduced in cases of polycythemia and that its internal secretion greatly overstimulates the bone-marrow in the production of the erythrocytes. The patient was in excellent condition when last observed in November.

SPLENO-MYELOGENOUS LEUKEMIA

CASE VI (A367,204) —Mrs C. D. a housewife aged thirty four years, registered in the Clinic August 3 1921. She complained of an enlarged spleen. She had been married eleven years and had one child living and well. Her menstrual periods had been regular. She had had typhoid fever in childhood and influenza in 1918. In 1911 during the birth of her child a severe pain had developed between the shoulder-blades, and later she had noticed a mass in the upper left abdomen. In August, 1920 the mass, which was painless, had become definitely noticeable. She consulted a physician and was told that her spleen was enlarged and that her blood was anemic. Iron preparations had been administered intravenously. The mass had grown larger and in January 1921 six Roentgen-ray treatments had been given without any apparent effect. During two weeks in May twelve further treatments had been given, which resulted in a decrease in the size of the mass and in the leukocytes. Two

hemorrhage and in May 1921 a severe hemorrhage from the bowel the patient also vomited blood. During June, 1921 he had phlebitis in the calf of the right leg which kept him in bed for one week.

September 12 1921 the spleen was removed it weighed about 900 gm. and was deeply buried in a mat of adhesions to the liver stomach omentum and abdominal wall. There were many huge veins in the splenic region. No gross pathologic condition other than in the spleen was found in the abdomen. A specimen of the liver was removed for microscopic examination (Fig 551) The convalescence was uneventful. September 29th the patient was up and about.

TABLE 5
BLOOD FINDINGS
(CASE A233491)

Date	12/13/18	5/8/19	6/30/21	9/7/21	9/12/21	9/20/21
Hemoglobin, per cent.	92.0	85.0	44.0	62.0		53.0
Erythrocytes, mill ilions	6.61	6.16	3.2	5.81		4.64
Color-index			0.6	0.8		
Leukocytes	14,000	22,400	23,200	32,300		41,000
P. lym. l. ra per cent.	83.3	79.0	87.5	85.5		
Small lymphocytes, per cent.	9.5	14.5	7.5	10.0		2.0
Large lymphocytes, per cent.	5.0	3.0	1.0	1.5		
Eosinophils, per cent.	1.0	2.5	3.5	1.3		5.5
Basophils, per cent.	1.0	1.0	0.5	1.5		0.5
Normoblasts.			5			
Anisocytosis			Slight			
Poikilocytosis			Moderate			
Polychromatophilia			Slight			

Patient returned for observation.

Splenoectomy

Convalescence uneventful.

Comment.—Polycythemia (rubra vera) is not a common disease. This case fulfils all the clinical criteria. The hemorrhage from which the patient suffered shortly before the opera-

between 2300 and 13 000 with an occasional myelocyte in the smear.

September 8 1921 splenectomy and cholecystectomy for gall stones were performed. The spleen was large (2360 gm.) lobulated, and extensively adherent, especially to the diaphragm and posteriorly. An accessory spleen 2 cm. in diameter found in the splenic pedicle was also removed (Figs. 552-553). The convalescence was uneventful except for slight pain in the left lumbar region.



Fig. 553.—(Case 367,204.) Fibrous of the spleen ($\times 100$)

Comment.—It has been generally believed that if a patient with leukemia were splenectomized he would die at once or if he did recover he would not be benefited. However it is a common experience that any reduction of the size of the spleen reduces the number of leukocytes and improves anemia. In our series of 27 cases of splenectomy for leukemia there was only one death and that from pulmonary thrombosis two weeks following operation. We reduce the size of the spleen and the number of leukocytes by radium which has a remarkable effect. When the leukocytes have been reduced to less than 20 000 the spleen can be removed without difficulty. In some cases we have been

weeks later however the mass had again begun to increase in size. The patient had never been jaundiced, her tongue had not been sore, and she had not had gastric disturbances. She had lost 7 pounds in weight during the last three months.

On examination the patient appeared to be well nourished the skin and mucous membrane were pale. Splenic dulness extended from the fifth rib in the axillary line to the level of the



Fig. 352 — (Case 367,204) Splenoregenerative leukemia distinctly lobulated spleen (weight 2360 gm) — is areas of perisplenitis and small accessory spleen.

umbilicus 6.25 cm. to the right of the middle line. Pretibial edema existed in both legs. The systolic blood-pressure was 120 the diastolic 62. The urine contained an occasional pus-cell. The Wassermann reaction on the blood was negative. The fragility of the erythrocytes was slightly increased on three tests there was, however, no history of jaundice or crises. The blood findings are shown in Table 6. The blood-picture showed an index varying between 11 and 07 and leukocytes varying

able by the use of radium temporarily to reduce the leukocytes from several hundred thousand to less than 5000. Several of these splenectomized patients have now lived more than five years following operation; all have shown temporary marked improvement, and were made much more comfortable. The expectation of permanent cure of leukemia by splenectomy is slight, but the operation has a field of usefulness in selected cases.

CONCLUSIONS

We know little concerning the pathology of the spleen, but the pathologic conditions found in the spleen are obviously closely related to the pathology of the blood. In about 270 splenectomized patients we have one group of about 12 whom we were wholly unable to classify even temporarily. It is best at this time to regard the spleen as little known territory through which very few trails have been blazed and to acknowledge our uncertainties in order that we may be more keen in interpreting old facts and gathering new ones.

CLINIC OF DR. HARRY H. BOWING

HODGKIN'S DISEASE TREATED BY RADIUM AND THE x-RAY: REPORT OF 4 CASES

CASE I (A87,394) —Mrs. W. A. B. aged forty years, came to the Clinic July 8 1913 because of stomach trouble and constipation, which had always required physics and enemas for relief. Bowel movements were painful with a sensation of tearing and bleeding. She had always had stomach trouble and aching in the epigastrium through to the back unrelated to food, lasting for from thirty minutes to twelve hours, without nausea or vomiting.

Physical examination was practically negative, with the exception that the right kidney was palpable the lower pole of the left kidney was palpable. A blood count revealed hemoglobin 90 per cent and erythrocytes 4,480,000. The gastric examination was negative.

September 9 1919 the patient returned to the Clinic. She complained of enlarged glands in the right and left supraclavicular and right and left axillary regions. In October 1918 she had had influenza, tightness in the chest and a cough associated with chills and fever which had persisted. It was more intensive when she was in a reclining position and caused a feeling of pressure in the left chest associated with some pain. Within two weeks after the influenza she had noticed that the glands were enlarged. Her temperature had been 101° F and she had had night-sweats. Shortness of breath, especially during the last few months, had made talking very difficult at times. The patient had gained slightly in weight, but her strength had been greatly diminished. The lower abdomen was very sore, particularly in walking. The bowels had continued constipated.

Physical examination revealed large discrete glands in the right supraclavicular area and similar glands in the left supra

wall, right and left supraclavicular areas and right and left inguinal areas were exposed to deep x-ray therapy

March 5 1920 the patient returned Her general condition had continued fair She tired easily Her appetite was good and she had not lost in weight She had had night-sweats during the last month Dyspnea was less marked Spitting of blood was attributed to a recent tonsillectomy The glands had

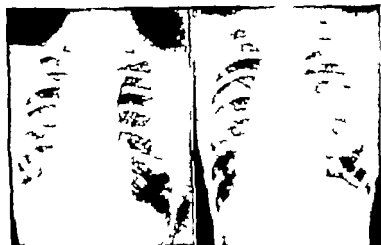


Fig. 554.

Fig. 554 —(Case A87,394.) November 5 1919. Large mediastinal shadow in Hodgkin's disease

Fig. 555.

Fig. 555 —(Case A87,394.) June 18, 1920. Reduction of hilar shadow following intensive deep x-ray therapy to the chest cavity. A negative roentgenogram as obtained.

decreased in size, and at times increased temporarily. A roentgenogram of the chest was negative. One thousand milligram hours of radium was delivered to the right cervical area. Deep x-ray therapy was applied to the anterior and posterior chest walls and right and left groins.

June 18th, when the patient returned again (Fig. 555) she stated that she "took cold" very easily and that her heart beat very "rapidly and pounding." She had been doing unusual and

clavicular area one large gland in the right infraclavicular area, one large gland in the left axilla, and smaller glands in the right axilla. The inguinal glands were very small and palpable. The weight was 106 pounds. The pulse was 118. Systolic blood-pressure for the right arm was 124 diastolic 82 systolic blood-pressure of the left arm was 110 diastolic 60. The temperature was 100° F. Rapid, slight diastolic murmurs were heard at the apex of the heart. An area of dulness was found 7 cm. to the left of the sternum and 5 cm. to the right of the mediastinum. In the left chest the dulness extended from the third rib down anteriorly and lower one-third posteriorly. Breath sounds were increased in areas above almost a bronchophony. There were practically no rales. Examination of the abdomen was negative. The uterus was in good position and normal in size. The blood count revealed hemoglobin 68 per cent., erythrocytes 4,560,000 leukocytes 15,200 polynuclear neutrophils 90 per cent. small lymphocytes 5.5 per cent. large lymphocytes 4 per cent., and eosinophils 0.5 per cent. A roentgenogram of the chest revealed a mediastinal tumor in the right side, with effusion at the left base. A gland was excised, and the diagnosis of Hodgkin's disease made by the pathologist.

July 28 1921 6300 mg. hours radium was delivered to two areas in the left of the cervical region, to three areas in the supraclavicular and axillary regions, and to three areas in the region of the spleen. Three areas on the anterior and posterior chest walls were exposed to deep x-ray therapy.

November 5 1919 the patient returned for observation. She had gained 6 pounds in weight she had not had night-sweats, but the pain across the upper portion of the abdomen had persisted. She had been very much constipated and had felt nauseated, but seldom vomited. The glands had decreased markedly in size. In roentgenogram of the chest slight improvement was observed (Fig. 554). A roentgenogram of the teeth revealed periapical infection. The patient was placed on Fowler's solution. Twenty-six hundred milligram hours of radium was delivered to the right and left supraclavicular right and left cervical and right and left axillary areas. The anterior chest

tumor reported to be about the size of a hen's egg, had been excised. Shortly afterward similar lumps had appeared in the left submaxillary and cervical regions these had been excised four and a half years later. Rapidly growing nodules in the left posterior cervical region had been noticed soon after the operation and excised about two and a half years before examination. The nodules, the patient stated varied in size from a pea to a



Fig. 556.



Fig. 557

Figs. 556-557 —(Case A317 905) June 1, 1920. Hodgkin disease. Marked distortion of features due to recurring glandular enlargements following many attempts at surgical removal. Marked edema of left half of face.

hen's egg. Since then lumps had appeared in the right submaxillary and cervical regions and in the scalp and lumps had recurred around the old incisions. From September to December 1919 forty α ray treatments and about twenty short radium treatments had been given, with much improvement. The patient's face the eyelids especially had been swollen continuously since the birth of her sixth child in August, 1919. Her feet were also markedly swollen. In December a mass in front

hard work. She was without fever. Her appetite was fair and she was holding her weight. She slept poorly. Twenty-five hundred milligram hours of radium was delivered to the right cervical region. Deep x-ray therapy was applied as before.

September 15, 1920 the patient returned. She complained of sharp constant pain in the lower abdomen. There was no pain in the chest, but a slight cough. The posterior chain of glands on the right side was slightly enlarged. One thousand milligram hours of radium was delivered to this area and deep x-ray therapy was applied as before.

January 12, 1921 when the patient reported for observation, the glands in the right cervical area were considerably larger otherwise there was no change. Sixteen hundred milligram hours of radium was delivered to the right cervical area and deep x-ray therapy was applied as before.

March 21st the patient reported that for the past two weeks she had had a slight cold with a full tight feeling in the chest, with rapid enlargement of the glands on the right side of the neck and under both arms. At the time of examination this had subsided considerably. The cough was much better. It was not productive. Physical examination revealed some enlargement of the glands in the right and left supraclavicular regions, right submaxillary and cervical regions, and right and left axillae. Thirty-seven hundred milligram hours of radium was applied to the involved area and deep x-ray therapy was applied to the anterior abdominal wall, the back, and the right and left axillae.

April 12th the superficial glands were markedly reduced in size and the patient felt much stronger. She had not gained in weight, but she looked improved. The glands in the neck and axilla had decreased in size. Deep x-ray therapy was applied to the anterior and posterior chest walls, to the abdomen and to the back.

CASE II (A317,905) — Mrs. G. G. aged twenty-eight years, came to the Clinic June 1, 1920 on account of multiple tumors of the head and neck. A small painless lump had been noticed first in the submental region eleven years before. Local applications had been made without effect. About one year later the

and a roentgenogram of the chest were negative. The Wassermann reaction on the blood was negative.

July 5 1920 ninety-seven hundred milligram hours of radium was delivered to the right and left cervical areas.

September 1st the patient returned for observation. The condition of the jaw and neck was markedly improved (Figs. 558-559). The swelling had subsided almost completely in the left cheek. It was slight around the left eye. The glands had reduced at least 80 per cent. The menstrual periods had been absent for four months, the uterus was the size of a four month's pregnancy. Thirty-seven hundred milligram hours of radium was delivered to the left cervical area.

November 8th the patient returned in good general condition. She had had some cough during the last few weeks but she attributed this to a cold. The glands on the side of the neck had been increasing in size again, she thought. Her general condition was about the same with a slight increase in the glandular enlargement which was confined to the cervical areas. The pregnancy was progressing and seemed uneventful. Twenty-nine hundred milligram hours of radium was applied to the left cervical areas.

CASE III (A327,080)—Miss I. H. aged twenty-two years, came to the Clinic July 29 1920. Since May the patient had had three distinct types of pain in the lower portion of the back: pain on the right, pain on the left, and pain beginning in the left lower back and radiating to the abdomen. At times the pain had radiated to the chest. The pain had come on in definite attacks, usually at midnight, and lasted until 4 A. M. It was knife-like in character and did not radiate along lines of the ureter. Deep breathing did not influence it and she was entirely free from it during the day. Relief was best obtained when she sat up and applied heat. Each attack had lasted two weeks. There had been no fever. There were no gastric symptoms. Enlargement of the glands in the neck had been noticed one month before examination. Since November 1919 she had had a chronic cough shallow and productive which began with a slight cold, and had persisted with periods of improvement. She had not

of the left ear and one posterior to the ear had ruptured and discharged. She had some pain in the chest at times and a slight cough.

The patient was well nourished and weighed 150 pounds. Marked swelling of the cervical glands on the right side of the neck extended from the base of the ear to the clavicle (Figs. 556, 557). A gland was removed for diagnosis; the pathologists



Fig. 558.



Fig. 559.

Figs. 558, 559 — (Case A317,905.) September 1, 1920. Hodgkin's disease. Marked reduction in glandular enlargement. The scars are responsible for incomplete absorption of edema. The improvement followed exposure to intensive radium treatment.

report was Hodgkin's disease. Examination of the urine revealed specific gravity of 1.018, acid reaction, and albumin Grade 1 on a scale of 1, 2, 3, 4. Hemoglobin in the blood was 67 per cent., the erythrocytes were 4,000,000, the leukocytes 5600, polymuclear neutrophils 48.5 per cent., small lymphocytes 36.5 per cent., large lymphocytes 13.5 per cent., eosinophils 1 per cent., and basophils 0.5 per cent. Examination of the sputum

September 27th very little change was noticed in the size of the enlarged gland fifty-six hundred milligram hours of radium was applied to the left cervical areas.

December 6th, when the patient returned for observation her strength was about the same and she had not lost in weight. The attacks of backache had remained unchanged aspirin gave relief. The cough persisted although it was not so productive. The suprastavicular glands were not noticeable. The left

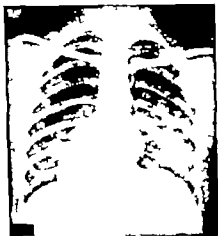


Fig 560.—(Case A327,080) Hodgkin disease. Chronic cough questionable due to mediastinal enlargements, although the slight glandular enlargement revealed in the roentgenogram are hardly sufficient to account for the cough. The consolidation in the middle right lobe, probably an abscess, which was not proved clinically in all likelihood is responsible for the cough.

axillary glands had remained about the same in size. Twenty three hundred milligram hours of radium was delivered to the right and left suprastavicular areas and to the left axilla. Deep x-ray therapy was given to the anterior and posterior chest walls.

March 7 1921 the patient returned. Her complaints were about the same except that she had discovered an enlarged gland in the right groin. Recently the feet and hands have



had night-sweats or fever. She had lost 16 pounds in weight since May. Her appetite had been good except during the spells of pain.

Physical examination revealed a well-nourished young adult with many glandular enlargements, chiefly in the left supraclavicular area measuring 0.8 to 1 cm. in diameter one gland in the right supraclavicular area 1 cm. in diameter and several glands in the left axilla the largest 2 cm. in diameter. The anterior pillar of the fauces on the left was reddened. The size of the tonsils was graded 2 on the basis of 1 2 3 4 with plugs. The teeth were in very good condition. The thyroid was slightly enlarged uniformly. Moist and persistent rales were heard over the apex of the lower right lobe posteriorly. The spleen was not palpable. The urine was acid in reaction and contained albumin 1. The hemoglobin in the blood was 59 per cent. the erythrocytes were 3,820,000 the leukocytes 11,200 polynuclear neutrophils 81 per cent., small lymphocytes 11.5 per cent., large lymphocytes 6.5 per cent., eosinophils 0.5 per cent., basophils 0.5 per cent. and slight poikilocytosis. The sputum was negative for *Bacillus tuberculosis*. The Wassermann reaction on the blood was negative. A combined phenolsulphonephthalein test gave a return of 60 per cent. in two hours and fifteen minutes. Roentgenograms of the chest revealed enlarged glands and irregular consolidation of the lung in the middle right lobe (Fig 560). Roentgenograms of the kidney ureter and bladder were negative. A gland was removed for diagnosis the pathologist's report was Hodgkin's disease. Tonsillectomy and radium treatments were recommended.

August 4th thirty-six hundred and fifty milligram hours of radium was given. Three areas were exposed in the right and left supraclavicular and right axillary areas.

September 1st the patient returned to the Clinic for observation. Her condition was about the same. A slight cold contraindicated tonsillectomy. It was not deemed advisable to treat with radium at this time. A roentgenogram of the lungs showed no change.

September 22d the patient returned for tonsillectomy

she had had intense itching of the skin. There had been no gastric or urinary symptoms.

The patient did not look well. Her weight (125 pounds) was 25 pounds below normal. The systolic blood-pressure was 105 the diastolic 80 the pulse 105 and the temperature 99.6° F. The glands in the right side of the neck, a small gland in the right supraclavicular space, two small superficial glands in the left posterior cervical region, and one small gland in the right supraclavicular region were enlarged. Chest expansion was diminished although not sufficiently to suggest diseased lungs. The specific gravity of the urine, alkaline in reaction, was 1.015. The hemoglobin was 68 per cent. the erythrocytes were 3,550,000 the leukocytes 4000.

June 22d the posterior triangle of the left side of the neck was dissected completely. The pathologist's report on the gland removed was Hodgkin's disease. Deep x-ray therapy was applied to the right and left supraclavicular and right and left cervical glands.

July 21st the patient returned. The field of operation was densely infiltrated and it was difficult to determine the real nature of the infiltration. It might have been due to the operation alone. The enlargement of the gland in the right supraclavicular area had disappeared. Thirty-six hundred milligram hours of radium was delivered to the left supraclavicular region and deep x-ray therapy was applied to the right and left supraclavicular and right and left cervical glands.

September 29th the patient returned, with a gain in weight of 6 pounds. She had recovered from her operation. Her face had itched and burned at times, increasing when she was restless from overwork. She was without pain and, as a rule, she slept well. She believed that she coughed less than before. She still was easily fatigued, but her appetite was good and she did not believe that she had had fever. Her weight was 135 pounds, the pulse 72 and temperature 98.6° F. The glands in the supraclavicular region on the right side were enlarged. A roentgenogram of the chest was negative (Fig. 561). Sepais in the tonsils was graded 3.

itching, with a sensation of heat. Menstruation was normal. Her appetite was fairly good, but she had been losing some weight. In January while at home, she had had x-ray treatments over the chest and back. The glands in the neck seemed to be normal in size. A few glands in the axilla were palpable and a large hard gland in the right groin. The urine was acid in reaction specific gravity 1.030 and albumin 0. The hemoglobin in the blood was 62 per cent. the erythrocytes were 3,820,000 and leukocytes 7600. Roentgenograms of the kidney ureters, and bladder were negative. Roentgenograms of the chest revealed an abscess at the right base of the middle right lobe with multiple small cavities probably bronchiectasis. March 10th fourteen hundred milligram hours of radium was applied to the left axilla and right groin. Deep x-ray therapy was applied to the anterior and posterior body surface.

April 13th when the patient returned for further observation, she reported that she had had no pain for the past two weeks. Her weight was 113 pounds. The gland in the right groin was smaller. The cough was about the same. She felt improved and was without the tired feeling. On physical examination the chest was found to be negative. It was not examined by the Roentgen ray at this time. Radium treatment did not seem advisable. Intensive x-ray treatments were given to the anterior and posterior body surfaces.

CASE IV (A319,178) —Miss J. P. aged twenty-seven years, came to the Clinic June 9 1920 complaining of enlarged glands of the neck weakness, nervousness, and cough. She had not felt well since having influenza in December 1918. The cough, which was fairly productive, had developed six months before. She had felt weak, slept poorly and her appetite had been poor. She had had fever (99° to 101° F) which had seemed to be worse in the afternoon, and a rapid heart. She had not had night-sweats. She had lost 20 pounds in weight since October 1919 when she first noticed the enlargement of the glands in the neck, which had progressed, fluctuating somewhat in size but without pain. For the last two years her skin had flushed easily particularly on exercising or in a warm room. At times

years she had had a dull heavy feeling in the frontal area. Her weight was 129.5 pounds pulse 96 temperature 99.8° F. The urine was acid in reaction and contained albumin 1. The hemoglobin was 62 per cent. the erythrocytes were 4,110,000 leukocytes 7400 lymphocytes 12.5 per cent. large mononuclears 2.5 per cent. basophils 0.5 per cent. and neutrophils 84.5 per cent. A roentgenogram of the chest revealed a bilateral medi-



Fig. 563—Gross specimen from the cervical glands removed surgically from patient with Hodgkin's disease. The nodes are shown intimately bound together by fibrous tissue.

astinal mass with fluid at both bases (Fig. 562). Physical examination revealed enlargement of the right cervical glands and activity in the left cervical area, marked bronchial pressure, and difficult expiration and inspiration. Intensive x ray treatments were given. The right and left supraclavicular areas, anterior and posterior chest walls, inguinal glands, and back were exposed to deep x ray therapy. The patient was instructed to return in three weeks for further observation.

October 9th tonsillectomy was performed.

May 11 1921 the patient revisited the Clinic, complaining of cough which three weeks before had increased suddenly and had become very distressing during the day and much worse during the night. It was slightly productive. For the last eighteen or twenty days she had been able to sleep only propped up in bed, and then with very little relief. She had a slight fever for



Fig. 561.

Fig. 562.

Fig. 561—(Case A293,198.) September 30, 1920. Hodgkin's disease. Roentgenogram reported to be negative. Ray therapy. The chest was not given roentgen therapy in the Clinic at this time.

Fig. 562—(Case A293,198.) May 11, 1921. Hodgkin's disease. Roentgenogram shows large mediastinal shadow. Hilar field at both bases. As routine in all cases of Hodgkin's disease the thoracic and abdominal cavities are exposed to deep x-ray therapy.

the last week or two. Pruritus had been intense for the last six or eight months. Dyspnea had been present for three weeks, and had made breathing at times almost impossible during the last five days. For two years the feet had swelled somewhat on exertion. She had had poor appetite for three weeks and had slept poorly. She did not have severe headaches but for



Fig. 566—Block applicators strapped in position with adhesive plaster. Lead disks, 1 mm. thick, rubber sheet, 2 mm. thick, fixed in position to protect the adjacent skin surface from the primary and secondary soft irradiations which are usually responsible for the distressing erythema.



Fig. 567—Front view of patient with block applicators in place as shown in Fig. 566.

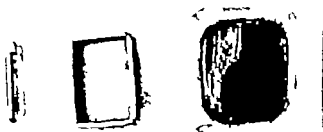


Fig. 564.—Universal tube applicator. Balsam wood block, 2.5 by 3 by 4 cm.
Lead filter 2 mm. thick.



Fig. 565.—Universal tube applicator. Balsam wood block and lead filter
assembled for application.

TREATMENT OF BRAIN TUMORS

ALFRED W. ARSON

THE treatment of brain tumors depends on the type and position of the tumor and on the effects of the pressure it produces. Not infrequently patients present themselves at the Mayo Clinic on whom decompressions have been performed for lesions other than those due to intracranial pressure, and blind and moribund patients suffering from inoperable lesions are brought for consultation. Such deplorable conditions are due, no doubt, to improper examination and diagnosis. Patients suffering from a group of neurologic symptoms should be carefully examined and properly advised by a competent neurologist and not be kept on potassium iodid as so often is done. Too many physicians feel that nothing can be accomplished if the condition is brain tumor and they do not, therefore have neurologic examinations made or encourage consultation with a neurologic surgeon. Other physicians believe that decompression is all that can be done for such patients and that an attempt to remove the tumor radically is not warranted.

The field of neurologic surgery is slowly developing and I believe, in time the neurologist and the neurologic surgeon will be able, after examination, to state whether or not a patient has an operable lesion and that more radical operations will be performed and fewer simple decompressions.

PATHOLOGY

Clinically brain tumors fall into two groups—cortical and subcortical, or operable and inoperable. The terms are not exactly synonymous, since some cortical tumors are inoperable and some subcortical tumors are operable. Another classification which might be made is encapsulated tumors and non-encapsulated tumors of the diffuse infiltrating type, or tumors



Fig. 568.—Block applicator fixed to irradiate the axillary glandular enlargements, with protectors in place. During application the arm is maintained at right angle.

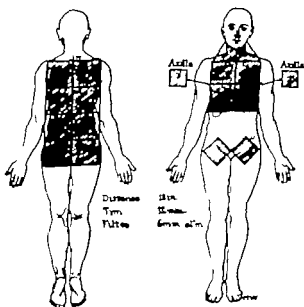


Fig. 569.—Areas exposed deep-ray therapy for Hodgkin's disease

the meninges. They appear most often over the cerebrum and are equally distributed over the frontal, temporal, and occipital lobes they produce symptoms by pressure rather than by invasion they originate from endothelial tissue and grow into the brain substance through the course of least resistance, and not infrequently after the area of dura involved is resected the

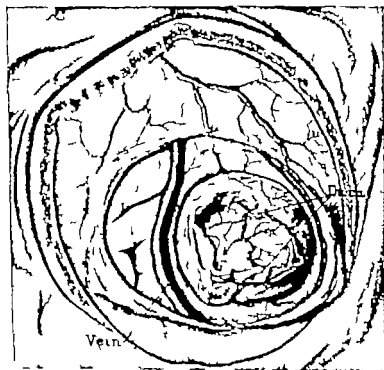


Fig. 571 —(Case A314,364) Encapsulated tumor with dura attached

tumor can be enucleated easily without destruction of the surrounding tissue by gently dissecting off the brain. Occasionally cortical vessels on the brain communicate with the tumor. If it is removed intact without breaking the membrane and if removed with the dura or sinus on which the tumor has arisen, no recurrence will take place (Figs. 570-572)

whose situation permits removal without destruction to the brain, and tumors whose situation makes removal hazardous. The greater percentage of operable tumors are endotheliomas, of inoperable tumors, gliomas and metastatic lesions. Endo-

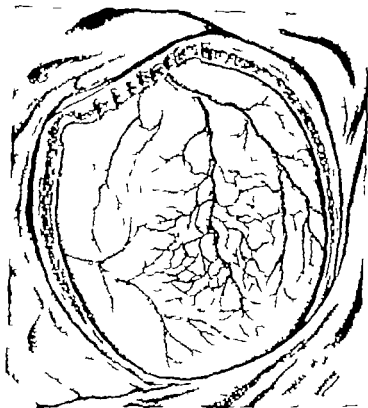


Fig. 570.—(Case A314,561.) Venous engorgement over solidus endothelioma.

theliomas include variations, such as neurofibromas and psammomas, while gliomas include hemangiogliomas, gliosarcomas, gliopsammomas, and so forth.

Endotheliomas arise from the endothelial tissue of the meninges and the large sinuses, the most common arising from

skull, so that an irregularity is visible and the enlargement of the skull presents itself as a rounded osteoma like knob. The thickened areas of bone along the longitudinal sinus are fairly diagnostic of an underlying endothelioma, even though intra cranial symptoms may not have appeared.

Intracranial neurofibromas occur most often as acoustic tumors, either single or with general involvement of the peripheral



Fig. 573—(Case A344,171) Roentgenogram (December 29 1920) showing subcortical calcified endothelioma in the right occipital lobe.

nerves. They vary in size from 1 to 4 cm. if operated on early they resemble endotheliomas. If degeneration has occurred they break easily have yellowish-pink appearance and the membranes correspond to the covering of the acoustic nerve.

Suprachiasmatic endotheliomas are very rare they occur underneath the frontal lobe, arising from the meninges and varying in size as a rule they are about the same size as neurofibromas and present about the same color and consistency.

Endotheliomas vary in size depending on the duration of growth. If the lesion is operated on when the first symptoms are manifest, it is usually from 3 to 5 cm. in diameter quite rounded, of a reddish tinge, and irregular presenting several centers of growth. The capsule is fairly thin, but definitely covers the

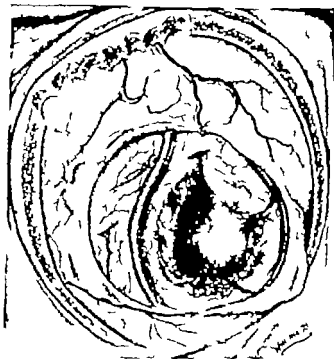


Fig. 572—(C. & A. 114561). Smooth bed of the tumor showing the convolutions of the minor vessels pushed aside. The patient recovered completely.

cellular growth. The tumor itself is moderately hard and the edges are well defined when sectioned. It rarely becomes necrotic at the center (Figs. 573-576).

Perianal endotheliomas produce sufficient irritation and develop sufficient blood-supply to produce thickening in the

Gliomas are far more common than any other type of brain tumor. They may be situated cortically or subcortically. If they are cortical they are purplish red and of about the consistency of the brain; they have no limiting membrane, and consequently it is very difficult to determine the distance they have infiltrated the brain. If they are situated subcortically they resemble the cortical lesions but occasionally they degen-



Fig. 576.—(Case 344 171.) Patient four months after removal of endothelioma shown in Fig. 575.

erate at the center and when explored yield quantities of yellow ropey gelatinous material. The destruction is probably due to the insufficient blood-supply. Numerous tumors of this kind have been known to degenerate completely, recovery finally taking place.

Sometimes these tumors take on malignant changes⁷ and other variations.



Fig. 574.—(Case 344,171.) Roentgenogram (January 22, 1921) after removal of endothelioma.

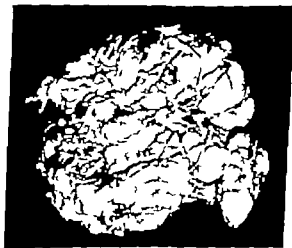


Fig. 575.—(Case A344,171.) Dark red nodules—definitely encapsulated endothelioma situated about 1 cm. beneath the surface of the cortex, extending almost to the corpus callosum. The tumor weighed 85 grs.

Independent of any indiscretion in diet and at any time of the day but is more prone to occur in the morning. The pain is sometimes described as a dull ache and sometimes as a bursting pain in any part of the head.

Vomiting is usually the second symptom. It is referred to as projectile in type and is brought on without relation to food. It occurs at any time during the day or night, regardless of whether the stomach is full or empty. It is liable to occur when the headache is most severe, and is manifested by a sudden violent expulsion of gastric contents for several feet.

Visual disturbance is, as a rule, the next symptom occasionally other localizing symptoms precede it. When the lesion is situated in a silent area of the brain or in a subcortical position, visual disturbance is the third symptom to manifest itself. The patient complains of haziness, until a fog as he describes it, blots out the vision. This is due to papillo-edema, which continues until the vision is destroyed by secondary optic atrophy. The papillo-edema is spoken of as choked disk, and is read by an ophthalmoscope in diopters. It is not uncommon for an inexperienced ophthalmologist to consider the papillo-edema an inflammatory process or to refer to it as some form of bulboretinitis and attribute its cause to sinus infection. Not infrequently through a lack of familiarity with intracranial neoplasms a secondary atrophy is allowed to develop before decompression is performed.

Pain and local tenderness may occasionally indicate the site of the neoplasm but are not pathognomonic signs. Patients suffering from cerebellar lesions often complain of pain and tenderness over the occiput and in the muscles of the neck, and of tender areas painful on palpation, which are at times significant if the sensitiveness is located over the frontal or parietal area of the skull.

DIFFERENTIAL DIAGNOSIS

Headache, vomiting and choked disks are symptoms of intracranial pressure and are usually due to intracranial neoplasms, or inflammatory processes producing cerebral edema or serous meningitis. Before a diagnosis of brain tumor is made

Metastatic growths are usually multiple carcinomas or sarcomas these growths are situated both cortically and sub-cortically and have the characteristic appearance of the primary growth.

The type of pituitary tumor produced depends on the tissue from which it arises. Strumas, adenomas, and carcinomas develop from the entoderm which makes up the anterior lobe gliomas and sarcomas arise from the posterior lobe coming from the glial tissues and cysts as well as benign and malignant tumors arise from the pars intermedia, which is composed of both entoderm and glial tissue.

Tumors of the gasserian ganglion are usually endothelial in type they rarely become very large and cause localizing symptoms before general symptoms.

Tuberculomas and gummas are not true brain tumors, but the symptoms they cause simulate those of brain tumor hence they must always be borne in mind when a diagnosis is being made. While they are prone to occur more often in children, they may occur in adults. They are both single and multiple they occur more often in the cerebellum than in the cerebrum, and may or may not be associated with tuberculous meningitis.

On examination of the mass *in situ* it is difficult to determine whether or not it is tuberculomatous but it can be differentiated when exposed, since a tuberculoma is usually situated subcortically is very hard and has no nodular definite capsule. It is not uncommon to find strings of nodules leading away from the principal mass along the blood vessels.

SYMPTOMATOLOGY

It would be quite impossible to collect all of the different groups and combinations of symptoms that manifest themselves with brain tumor. I shall therefore, review only some of the more practical points in the symptomatology.

Headache is one of the early and pronounced symptoms. It comes on intermittently is fairly mild at the onset, but continues to progress until it is extremely severe it usually occurs

This is particularly true since the prevalence of influenza. The spinal fluid occasionally gives evidence of chronic inflammation in an increased cell count and a positive Nonne. The fluid itself is usually clear but the swelling of the optic nerve head rarely becomes so marked in encephalitis as in brain tumors.

The possibility of brain abscess must also be considered before a diagnosis of brain tumor is made, inasmuch as brain abscess is preceded by encephalitis, and while developing simulates brain tumor. A brain abscess passes through three stages—the initiatory, the quiescent, and the terminal. During the initiatory stage the onset of the infection is associated with encephalitis, resulting in a diffuse encephalitis and death, or in a circumscribed encephalitis with softening and pus formation. In many instances the disease passes into the quiescent stage with little trouble except for symptoms of intracranial pressure, which are difficult to distinguish from those produced by brain tumor. In the third stage the abscess is either absorbed and the tissues heal which is very rare or there is a rupture of the abscess into the ventricle which produces diffuse encephalitis, basal meningitis and death.

Two laboratory procedures have been employed in an attempt to determine the presence of brain tumor. One is the Abderhalden test, which has not been very generally accepted. The other is ventriculography. The latter procedure has been of distinct value in some cases but it cannot be practised indiscriminately since it is not unattended with surgical risk. Further study is necessary in order to carry out the purpose of the test, which is to localize an operable tumor when neurologic diagnostic means have failed.

After the possibility of a diagnosis of an inflammatory process has been eliminated it must be inferred that the symptoms of intracranial pressure are due to a neoplasm. A tumor around the brain stem or in the cerebellum where it obstructs the outward flow of cerebral fluid through the aqueduct or the foramina of Magendie or Luschka, need not be very large to cause exaggerated symptoms. On the other hand, a tumor in the frontal, temporal or occipital lobes may grow to 9 cm. in

It is quite necessary therefore to eliminate the possibility of acute meningitis of an epidemic type, or localized pyogenic meningitis encephalitis, or chronic meningitis due to *Bacillus tuberculosis* or syphilis. The history is of great value in this connection. If the trouble has been present for several months usually the possibility of acute infection can be ruled out. If there is any doubt, a spinal puncture may be made unless a choked disk of more than 3 diopters is present or if there is marked evidence of an infratentorial lesion manifested by cerebellar inco-ordination. The spinal puncture will reveal the presence of any acute infection. The normal cerebrospinal fluid is clear with a negative Nonne a cell count below

If the patient has epidemic meningitis the spinal fluid will be cloudy containing many pus-cells, a few of which probably include the meningococcus, and the cell count will be high. If the meningitis is caused by a pus-forming organism the findings will be the same the organism however will be different.

Chronic meningitis may continue for several months, in which case the history is of value in determining the onset of the trouble the possibility of tuberculous or syphilitic lesions elsewhere in the body and of syphilis of the central nervous system.

Patients with tuberculous meningitis rarely recover thus prolonged symptoms usually preclude the diagnosis of tuberculous meningitis. Tuberculoma of the brain with localized circumscribed meningitis exists at times for months and cannot be differentiated from brain tumor. Syphilitic meningitis is confusing since if there are no symptoms referable to the central nervous system such as are manifested in *tabes dorsalis* or in general paresis, the intracranial pressure simulates brain tumor. Again the spinal puncture is of value since there is usually a positive Wassermann reaction, increased cell count, positive Nonne and second zone Lange. The spinal fluid in patients suffering from tuberculous meningitis is clear with increased lymphocytes, a positive Nonne and active tuberculosis bacilli. If bacilli cannot be demonstrated in the stain a guinea-pig inoculation test may be necessary.

Encephalitis sometimes presents very confusing symptoms.

A certain group of patients develops grand mal convulsions in conjunction with the symptoms of intracranial pressure without localizing signs. Such convulsions do not enlighten the examiner appreciably but they emphasize the presence of a lesion, producing either direct or indirect pressure on the temporosphenoidal lobe which is probably subcortical.

Unlocalized tumors are usually found in the silent area of the brain the frontal and temporal lobes and the postcentral region above the optic radiation are most often involved.

Tumors of the cerebellum rarely develop without marked symptoms. Inco-ordination and symptoms of intracranial pressure are the first manifestations these are followed by pronounced disturbance on one side or the other of the body associated with involvement of the cranial nerves. In the classic acoustic syndrome the symptoms are tinnitus aurium beginning deafness with symptoms of intracranial pressure complete deafness, weakness in the seventh nerve and if the growth is permitted to continue, cerebellar ataxias and involvement of the cranial nerves having their exit in the vicinity of the internal auditory meatus. Tumors of the vermis or from the roof of the fourth ventricle give symptoms of cerebellar disturbances with few if any additional localizing signs.

Pituitary tumors produce hemianopsias, metabolic disturbance in the form of gigantism, and adiposis genitalis, acromeglia, and dyspituitarism.

Tumors of the gasserian ganglion usually cause pain followed by anesthesia. As the tumor grows it extends medially and posteriorly and involves the cranial nerves in that vicinity usually the sixth the fourth and the third. Basal tumors invading the skull through the foramina cause localizing symptoms and result in paralysis of the nerves in their immediate vicinity before causing symptoms of intracranial pressure, except in high spinal cord tumors which enter the skull through the foramen magnum. These may result in early obstruction of the outflow of cerebrospinal fluid causing headache choked disk, and vomiting.

diameter without producing choked disks and be associated with only mild headache and little or no vomiting. It is also true that tumors situated subcortically in the cerebrum are more liable to produce the three cardinal symptoms of intracranial pressure (headache, choked disk, and vomiting followed by paralysis) than those situated on the cortex, which more often produce localizing symptoms in the form of motor or sensory Jacksonian convulsions, with headache and localized tenderness, but less vomiting and less swelling of the optic nerve head.

After the diagnosis of intracranial neoplasm has been made by a process of elimination symptoms of localization should be looked for. The gross anatomy of the brain should be borne in mind, especially the centers controlling certain parts of the body: the precentral motor convolution with its various divisions; the postcentral sensory area; the speech center in the island of Reil or Broca's area; the center of asteriognosis in the superior temporal convolution on the left side; the optic center in the occipital lobe; the center of smell and taste in the uncinate and hippocampal gyri; the centers of cerebration in the frontal convolution; the nuclei with the various cranial nerves in the brain stem; the courses and the exit of the various cranial nerves with their relation to the skull; the significance of the semicircular canal and its relation to the cerebellum through the acoustic nerve, and the level of the different decussations of the motor and sensory pathways.

In a large percentage of brain tumors of short duration there are no definite localizing symptoms, and this type of tumor is badly treated since it is neglected until secondary optic atrophy has developed. Patients should be given thorough neurologic examinations since mild localizing symptoms may be elicited besides those of intracranial pressure such as disturbance of a reflex, slight weakness in a cranial nerve or sufficient tenderness to indicate localization of the neoplasm and warrant exploration in conjunction with the decompression. If symptoms of paralysis, Jacksonian convulsions, hemianopsias, either homonymous or bilateral, if gustatory or olfactory disturbances and aphasia are present, the brain tumor may be definitely located.

Decompression is of value in cases of slowly progressing choked disks but is of little value in cases of rapidly developing choked disks of short duration.

Technic of Operation.—A simple decompression should be performed under the temporal muscle and the skin incision should be made obliquely upward and backward from the zygoma corresponding to the line of radiation of the temporal muscle. After incising the skin, galea, temporal fascia, and muscle the muscle should be carefully elevated with a retractor without being torn loose from its distal attachment. The skull should be trephined and an area of from 4 to 6 cm. in diameter ringed away underneath the temporal muscle. After the bleeding is controlled the dura should be opened by a crucial incision and the ventricle tapped, if possible, by a trocar and cannula. Careful exploration of the brain in the immediate vicinity is advisable, since occasionally evidence may be obtained with regard to the position of an unlocalized tumor. The surgeon should be very careful in his palpation and manipulation of brain tissue, and avoid unnecessary trauma to the blood vessels. The cortex around the tumor should be covered with moist cotton during the operation and the cortex and cotton kept warm with normal saline solution. In closing the wound good coaptation of the muscles, fascia, galea and skin margin is important. It is best obtained by suturing the different planes of tissue by interrupted sutures of No. 1 silk. The temporal fascia should be closed very accurately so as to insure against disfiguring cerebral hernia. Owing to the danger of infection and the leakage of cerebrospinal fluid the use of drains should be avoided. The patient should always be informed of the defect in the skull following such a procedure and of the moderate bulging and pulsation that will develop.

Osteoplastic Flap—Usually exploration of the cerebrum is through an osteoplastic flap with its base in the temporal region. Care must be taken not to disturb the temporal artery if the flap is pedunculated. The location of the base of the flap is optional but the base must be as broad, if not broader than the free margin if it does not contain the temporal artery.

SURGICAL TREATMENT

The anesthetic of choice in the surgical treatment of brain tumors has been given much consideration. In the greater number of traumatic cases local anesthesia is indicated, but in craniotomies for neoplasms it is not so satisfactory. Most decompressions can be performed without very much pain to the patient, but extensive osteoplastic flap operations are best carried out under a general anesthetic as traction on the dura produces considerable pain. Some patients co-operate with the surgeon sufficiently to permit a local anesthetic, but in the majority of cases either is advisable unless there are definite contraindications. Ether administered by the drop method can be employed in practically all craniotomies. It was believed at one time that in all cases of cerebellar tumors the anesthetic should be administered by the intratracheal or intrapharyngeal method, but since it has been possible to insure sufficient air with the ether and freedom of the mandible, tongue, and neck by supporting the head in a special frame neither intratracheal nor intrapharyngeal anesthesia is necessary.

Decompression.—In all patients suffering from choked disks of more than 2 diopters decompression is indicated, except when the disks are choked due to known inflammatory processes under control. I doubt its value in patients suffering from choked disks in conjunction with atrophy which has progressed to a state of blindness in the absence of definite localizing signs, and I do not consider it advisable in patients suffering from headache alone or from headache and vomiting without choked disks. Neither do I consider decompression advisable in patients suffering from grand mal migraine or cerebral diplegias without evidence of intracranial pressure, and I believe that in all patients presenting symptoms of localization, even though the suggestive symptoms are slight, exploratory craniotomy is indicated in conjunction with subtemporal decompression at the base of the osteoplastic flap. A surgeon should never be satisfied with performing a decompression only when there is marked evidence of localization, since a patient should by all means be given the benefit of an exploration with possible removal of the neoplasm.

by traction on the dura. If the endothelioma arises from the falx cerebri or from the meninges under the cerebrum, it may be necessary to incise the cortex in order to expose the tumor and permit elevation. This can be safely done in the temporal, frontal, and occipital lobes. After the tumor has been removed the dura is closed with interrupted silk sutures and the defect covered with animal membrane (prepared peritoneum of the ox). If the endothelioma arises from the longitudinal sinus particularly from the anterior portion or from the lateral sinus, it is necessary to remove away bone or turn a flap to give additional exposure to permit ample room for removal of the tumor. The sinus is very liable to be partially or completely obliterated by endothelial buds of tumor-cells and resection of the involved sinus in addition to the dura is frequently necessary.

Operations for Cerebellar and Brain Stem Lesions.—In cerebellar and brain stem lesions bilateral cerebellar decompression through a cross-bone incision is advisable, after which the dura over each cerebellar lobe is incised and the occipital sinus doubly ligated and divided. If much pressure is present the lateral ventricle above the lateral sinus should be tapped through a separate trephine opening, and the lateral ventricle drained through the posterior horn. Cerebellar tumors are approached and removed in the same manner that cerebral tumors are removed. Acoustic tumors and tumors in the cerebello-pontine angle are exposed after the bilateral cerebellar decompression and the incision of the dura and occipital sinus. The cerebellar lobe is covered with strips of moist cotton and gently elevated and displaced in order to give ample exposure of the tumor in the angle. It is well to use an illuminating retractor in order to obtain sufficient light, and cotton should be packed around the tumor to prevent the flow of blood underneath the base of the brain. If the lesion is a simple acoustic tumor the capsule is split and the tumor enucleated piecemeal. If the lesion is malignant or has invaded the brain stem it is questionable whether an attempt at removal should be made. The surgeon may be tempted to enucleate the mass intact, but such manipulation is liable to be attended with severe complications in

Bleeding from the scalp on the flap side is controlled by a pedicle clamp at the base of the flap compressing the temporal muscle and all the vessels and skin. The bleeding in the scalp around the margins of the incision is controlled by forceps to the galea which are turned out over the skin margin. The forceps are held in place during the operation. Four trephine openings are made with a Hudson drill or by the use of an electric burr. The dura is separated from the skull at various openings, after which the DeVilbiss or the Frazier osteotome attachment to the DeMartell engine is used to narrow in the bony margin from the two lower trephine openings. The Gigli saw is then used between the openings to finish freeing the flap. In using the saw it is well to draw it a little diagonally in order to give the beveled effect in the bone-flap. The bone-flap is elevated and broken at its base in the temporal region. The edges of the wound are carefully covered by towels and soft moist sponges. Careful palpation is made over the cortex for any difference in resistance for fluctuation, or for the detection of solid masses. If the tumor is situated in the cortex or on the cortex, the dura, skull, and scalp are usually found to be very vascular. Before the dura is opened it is well to drain the lateral ventricle by a brain trocar and cannula. If a tumor is found and cerebrospinal fluid not obtained the dura might be opened over the tumor as well as over the temporal region but if no tumor is found and no fluid obtained on puncture the dura should be opened with care, except in the subtemporal region immediately under the temporal muscle in the decompressed area produced at the base of the flap. If a glioma is found the advisability of attempting its removal is questionable. It is practically impossible completely to remove a soft mass. If the mass is necrotic or degenerated evacuation of the contents is advisable. Occasionally glioma degenerates and forms a large cyst, which can be drained, and the remaining nodule or glioma in the cyst wall can be removed.

Removal of Endotheliomas.—If an endothelioma is exposed, it is well to excise the attached dura and carefully dissect away the brain tissue ligating the communicating vessels or controlling the bleeding with Cushing clips and gently elevating the tumor

day until the end of ten days when it can be removed and the head covered with a comfortable head-dress. Repeated ophthalmologic and neurologic examinations are advisable during convalescence.

END-RESULTS OF OPERATION

Decompressions in mild cases of intracranial pressure from tumor give relief from the headache within a few days after operation, but in severe cases the relief is slower and less complete. The average patient will be free from intracranial symptoms for from six to eighteen months.

Following the successful removal of a brain tumor relief from headache, choked disk, and vomiting is experienced soon after operation and usually the patient is very comfortable after two or three weeks. Improvement in motor paralysis is early and continues for from six to ten months, when recovery will be either complete or remain stationary. During the convalescence massage and passive motion should always be employed. If there had been symptoms of grand mal an amelioration of the severity of the attacks with a decrease in frequency may be expected for the first two years; if by that time there is no relief hope for complete freedom from the convulsive attacks should not be entertained. In cases of this type it is advisable to prescribe bromids postoperatively the dosage varying according to the case but ranging from 30 to 60 gr. a day for adults.

SUMMARY

1. Decompressions are indicated for patients suffering from intracranial pressure but they are of no value for patients suffering from migraine, cerebral diplegia, idiopathic grand mal or for patients who have developed complete optic atrophy without localizing signs.

2. Exploration of the brain with an attempt at radical removal of the lesion is indicated for all patients suffering from localized brain tumors, and should be performed in preference to simple decompression.

3. Doubtless radium will be a valuable adjunct in the treatment of inoperable and partially removed brain tumors.

the form of paralysis of other cranial nerves. Since tuberculomas are masses within the brain substance if removal is attempted, it is necessary to resect the brain substance around the nodule.

Operations for Suprachiasmatic Tumors.—Suprachiasmatic tumors on account of their position and the associated bleeding are difficult to remove and it is questionable whether radical measures should be employed in their treatment. Tumors of the ganglion are approached through the middle fossa much the same as in the division of the posterior root for trifacial neuralgia. Brain abscesses, if exposed through an osteoplastic flap craniotomy should be carefully drained with as little trauma and soiling as possible and the cavity washed with normal saline solution and aspirated. Small rubber tubes should be brought through a puncture incision or at the edge of the flap to provide for drainage.

Value of Radium.—The exact effect of radium on brain tumors has not yet been determined. It seems probable that it will be a valuable adjunct in the treatment of inoperable tumors, in the prevention of recurrence of tumors when intracapsular removal has been performed, and in the retardation of the growth of partially removed tumors. Apparently better results are obtained by the use of radium in the destruction of endothelial growths than of gliomatous growths. A definite statement with regard to the dosage of radium cannot be made at present but I believe large doses, more than 1000 mg. hours at a time, are indicated and the implantation of radium is more effective than external application. Repeated external applications of radium however at intervals of from two to three months are beneficial in some cases. When complete removal of a brain tumor is impossible the administration of radium should be considered.

Postoperative care of patients with brain tumors is very similar to the treatment of patients with general surgical conditions. Morphine should be used sparingly. Ice-bags should be applied to the head, and the patient should be kept in bed until usually about the fifth day when he feels strong enough to sit up. The superficial stitches should be removed at the end of seventy-two hours and the dressing changed about every third

OCULAR PHENOMENA IN CASES OF CHIASMAL LESIONS NOT OF PITUITARY ORIGIN: REPORT OF 6 CASES

WALTER I. LILLIE

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THE early ocular changes produced by lesions of pituitary origin may be summarized as follows (1) Lowered visual acuity in one or both eyes, (2) characteristic changes in the visual fields, and (3) waxy pallor of the nerve heads without loss of substance.

The progressive field changes due to chiasmal lesions of pituitary origin have been adequately described by Cushing and Walker who have classified them in four main groups (1) bi-temporal (2) homonymous, (3) amaurotic, and (4) unclassified. The field changes are also classified according to the progression and type of change (1) changes in the color fields, (2) changes in the form fields and (3) bizarre fields, such as scotomatous fields.

The ophthalmoscopic appearance of the nerve heads and the relationship between this appearance and the loss of vision has been described in detail by Benedict. A peculiar waxy pallor of the nerve without shrinkage is seen so often that it has become practically a diagnostic feature. The pallor is not due to atrophy of the optic nerve, unless vision has been destroyed almost entirely for a considerable length of time and it is accompanied by an atrophic excavation of the disk, such as is seen in atrophy of tabes and toxic neuritis. In the atrophy of tabes the pallor of the disk, the loss of vision, and the shrinkage of the nerve itself progress together. If any difference is found, the vision often seems too good for the extent of pallor and excavation of the disk seen with the ophthalmoscope. In toxic neuritis the vision falls first the shrinkage of the nerve and the pallor of the disks follow together. In the case of pressure at the chiasm from pituitary or other tumor the appearance of the pallor of the disk may not be noticeable for years after the onset of the loss of vision. The pallor is not accompanied by shrinkage of the nerve sub-

TABLE 1
OCULAR PHENOMENA IN 6 CASES OF CHIASMAL LESIONS NOT OF PITUITARY ORIGIN

Case	Sex Age	Condition of the retina in the fundusgamm	Visual fields	condition of the disks	Visus	General conditions
132,904	M 29	(V) normal 20 enlarged, Grade 2, with thinning of the posterior chiasma	Right temporal hemianopsia Left 15 blind	Right crystalline lens pale slight loss of substance Left normal pale without loss of substance	Right 4, 10 Left 10	Negative. Basal metabolic rate—7 per cent.
296,544	JJ	Normal	Repetitive bilateral hemianopsia	Right normal. Left normal	Right 10 Left 10	Optic atrophy. Severe breaker of the cones, blood, and deep reflexes increased. Redness on the right. Optic atrophy. Basal metabolic rate normal. Basal metabolic rate normal on the left. Cerebral atrophy with loss of cerebellum. Mildly toxic. Subcortical tumor above the brain.
341, 36	F 49	Normal	Right temporal hemianopsia with involution of the upper outer, inferior, () temporal hemianopsia	Right normal Left temporal pale with loss of substance	Right 10 Left 6/20	Weakness of the right seventh and left fifth nerves. Basal metabolic rate— per cent.
344, 907	M 37	Enlarged, Grade 4, with de- struction of the posterior chiasma	Left homonymous hemian- opsia	Right pale without loss of substance Left pale without loss of substance	Right 20 Left 6/15+	Essential hypertension, destruc- tion of the posterior chiasma, muscle atrophy grade — Basal metabolic rate — 7 per cent.
348, 903	F 45	Normal	Bilateral hemianopsia	Right slight pale without loss of substance. Left normal pale without loss of substance	Right 4, 8 Left 4, 10	Negative
362, 271	M 29	Enlarged, Grade 3.	Right homonymous hemian- opsia	Right simple optic atrophy Left simple optic atrophy	Right 6/20 Left 10	4/24/71 basal metabolic rate —27 per cent. 7/ 4/71 basal metabolic rate —18 per cent.

Counts August.

stance or atrophic excavation. Benedict's description is in agreement with that of Cushing and Walker who state: "Despite the so-called atrophic pallor of the disk in patients having visual field defects resulting from lesions in the chiasmal regions, the histologic examination of the nerve fails to show the expected degree of fiber degeneration unless the progress has been of long duration."

From a group of 30 cases of chiasmal lesions for which operation was performed in the Clinic in the past twenty months the 6 cases (20 per cent.) here reported were selected. The remaining 24 cases of this group were of pituitary tumor. These 6 cases are reported in order to show the striking similarity in the ocular phenomena of chiasmal lesions not of pituitary origin to those of chiasmal lesions of pituitary origin (Table 1)

REPORT OF CASES

CASE I (A152 904) —Mr M. R., aged twenty years, was first examined February 24 1916 because of blindness in the left eye. He had complained of poor vision for two years with diplopia and frequent headaches. Glasses improved the condition for nine months, when he had a very high fever with vomiting and headache and within three or four hours total blindness in the left eye. The right eye had been normal until two months before examination when vision had become smoky and he could not see to read or write. The headaches persisted over the eyebrows, but they were not so frequent. He had vomited only once or twice during the last three months. He had lost slightly in weight.

The general examination was negative. The roentgenogram of the sella turcica was negative and the Wassermann reaction on the blood was negative. Vision in the right eye was 20/70 in the left eye nil. The right fundus was negative but the left fundus showed a complete simple optic atrophy. Perimetric fields showed temporal hemianopsia in the right eye. The neurologic examination was negative except for the ophthalmic findings. A diagnosis of questionable pituitary tumor was made.

March 23 1916 a right subtemporal decompression was performed (Dr Beckman) Considerable cerebrospinal fluid escaped, but it was not under much pressure. The patient was dismissed after an uneventful convalescence.

January 21 1920 the patient returned to the Clinic because vision in the right eye had failed since his previous visit to the Clinic. He had had periods in which the vision was poor but generally the vision had remained good until the last few months, when it had failed steadily Examination revealed the vision in the right eye to be 3/60 in the left eye nil The pupils were

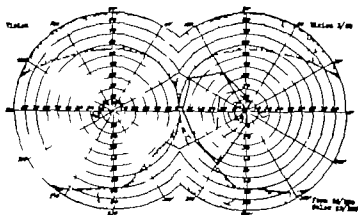


Fig 577 —(Case A152,904.) Right eye, temporal hemianopsia. Left eye blind

equal the right pupil reacted promptly to direct light and in accommodation the left pupil did not react to light, but reacted in accommodation. The right nerve head was greenish white throughout without loss of substance the arterioles and veins were normal. In the left eye the media were clear the nerve head showed a marked pallor without loss of substance (Fig 577) The patient developed a mild attack of influenza and was in bed one week. A slight cough persisted, and he felt weak, although his appetite improved steadily The general examination after influenza was negative except for a mild bronchitis. The roentgenogram of the head showed the sella turcica slightly

TABLE 2
RELATION OF OPHTHALMOSCOPIC APPEARANCE OF THE NERVE HEADS AND THE DURATION
OF THE VISUAL SYMPTOMS

Cases	Condition of the disks	Duration of the visual symptoms	Condition of the retina in the rovingograms	Pathological changes
152,904	Right: Overlaid white pallor. Marked loss of substance. Left: Marked pallor without loss of substance	Right: four years. Left: six years.	normal No enlarged Grade 4 with thinning of the posterior lamellae.	Representative basal tumor and glaucoma.
200,394	Right: normal Left: normal	ten years in both eyes, worse in the left	Normal	Glaucoma of the middle lense.
342,838	Right: normal Left: pallor. Marked loss of substance	Eleven months in both eyes	Normal.	Normal. Glaucoma in lense.
346,907	Pallor of both disks without loss of substance	Four years in both eyes	enlarged Grade 4 with decrease in the posterior lamellae.	Unable to remove spindles for rovingograms.
200,995	Right: slight pallor without loss of substance. Left: marked pallor without loss of substance	Six months in both eyes, worse in the left	Normal.	Protrusion of the meninges.
343,971	Right: simple optic atrophy Left: simple optic atrophy	Four years in both eyes, worse in the left	Enlarged Grade	Small cellular glioma.

than the blindness she was not told of the other attacks. The attacks came on in the night, with deep breathing and frothing at the mouth. She was not rigid but she could not be aroused for one-half hour the next day she was very tired. For the last five weeks she had been conscious of a peculiar odor as of coal-gas, for half a second or so with a peculiar sensation in her nose and on the right side of her throat.

General examination revealed uterine fibroids. A roentgenogram of the sella turcica showed it to be normal. The roentgenogram of the chest revealed slight bronchial thickening. The Wassermann test on the blood was negative the nasal pharynx was negative. The eyes were normal in size, shape, and position. The pupils were dilated equally and reacted sluggishly to light and in accommodation. Vision in both eyes was nil. Examination of the fundus in the right eye revealed a pink nerve head the margins of which were slightly blurred at the outer and lower border but no swelling in the left eye the nerve head was pink and oblong in shape otherwise the fundi were negative. A letter from D. Litchfield, of Minneapolis, stated that September 23d the patient had had a temporal hemianopsia in the left eye and temporal hemianopsia in the right eye with contraction of the nasal field. The neurologic examination revealed a static tremor of the tongue, hands, arms, and legs. Deep reflexes were increased. The Babinsky reflex was positive on the right side the Oppenheim, Rossolimo and Gordon reflexes were positive on the left side. The Bárány test suggested pressure above the stem and beneath the cortex (subcortical). The diagnosis was tumor in the region of the pituitary probably partially above the chiasm.

December 12, 1919 the patient was operated on by Dr. Adson. The notes dictated at the time of the operation are:

A tumor was found between the optic peduncles the line of cleavage between the brain and tumor could not be dissected. The left peduncle could not be seen. The right peduncle was about four times normal size its outer surface was purplish and looked as if it might cover a tumor or hematoma. In the attempt to enucleate the tumor by first opening the capsule severe arterial

enlarged with thinning of the posterior clinoids, trephine in the right temporal region. The neurologic examination was objectively negative except for eye findings. The metabolic rate was -7 per cent. A diagnosis of pituitary tumor was made. The patient returned home to recuperate from the influenza before operation.

The second operation was performed May 11 1920. At this time the vision in the right eye was 1/60 in the left eye nil. The *fundi* were the same as previously reported. Dr Adson operated, and reported findings as follows. A mass was found situated between the optic peduncles and extending underneath the brain. This mass was dark red without definite capsule, and did not come down into the sella, but up between the peduncles, spreading them for a distance of 3 cm. Some tissue was removed for diagnosis, but the tumor could not be removed. A diagnosis was made of supratentorial basal tumor. The pathologist reported malignancy. The patient died May 13 1920 necropsy was refused.

Ophthalmologically this case could not be differentiated from that of pituitary tumor. It is interesting to note that the sella showed no change so far as could be determined by the roentgenogram until nearly five years after the onset of the visual symptoms.

CASE II (A298,594) —Miss B. L., aged thirty-three years, was examined December 2 1919 because of loss of vision in both eyes. Radium treatment in April and in June for fibroid tumor of the uterus had controlled the hemorrhages she had had every month. July 1st she awakened with blurred vision in both eyes this gradually grew worse until she was only able to read the headlines in the paper. She was able to continue her work, checking large figures, until October 18th. In walking on the street she often bumped into persons coming upon her left side, but she was able to see them in front of her or on her right side. The left eye became worse more suddenly than the right. For the last five weeks she had been unable to detect light. During the last two weeks she had had three attacks of loss of consciousness. She knew of one attack and this caused her more anxiety

to count fingers 2 feet in the nasal field vision in the left eye 6/20. The pupils were equal and reacted somewhat sluggishly. On the examination of the media in the right eye a few floating vitreous opacities were noted; the nerve head was round, of good color, perhaps slightly pale in the temporal half; in the left eye the media were clear, the nerve head round, rather pale in the temporal half with perhaps a slight loss of substance. The pallor of the disks was not sufficient to be typical of pituitary tumor. The visual fields showed bitemporal hemianopsia with

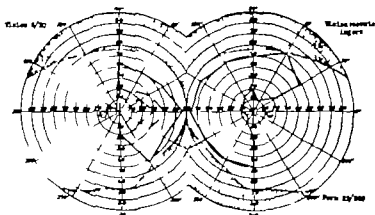


Fig. 578.—(Case A342,936) December 6 1920. Right eye loss of part of the superior temporal quadrant and all of the inferior temporal quadrant, including the macular region; no recognition of colors. Left eye temporal hemianopsia; no recognition of green.

preservation of the upper outer quadrant in the right eye; loss of vision for all color in the right eye and loss of vision for green in the left eye (Fig. 578). The neurologic examination revealed slight weakness of the left fifth nerve, and apparently slight weakness of the left seventh nerve around the mouth; the deep reflexes were slightly increased. A diagnosis of brain tumor near the chiasm was made; not typical of pituitary tumor. The patient was dismissed December 18th without operation.

April 5 1921 the patient returned to the Clinic. Examination of the eyes showed vision of the right eye 1/30 nasally; vision of

hemorrhage developed which was difficult to control. Only a portion of the tumor was removed. The pathologist's report was glioma.

The patient died the evening of the operation. On necropsy a glioma of the middle brain was found infiltrating the optic tract, with marked increased intracranial pressure and herniation of the right temporoparietal lobe. The sella turcica was unusually deep.

The ophthalmologic examination in this case gave no suggestion as to the location of the tumor. At the time of our examination the patient's vision was nil and no visual fields could be obtained. The bitemporal hemianopsia reported to us and the normal nerve heads found at our examination led us to believe that the patient had a chiasmal lesion. The neurologic examination revealed a definite localization of the tumor.

CASE III (A342,936) —Mrs. O. D. T., aged forty years, was examined December 6, 1920 because of poor vision in both eyes. She had first noticed loss of vision in January 1920 when in reading she could see the last half of the word before she saw the first half. Vision gradually diminished until she was unable to read. About four months ago she had noticed that she could see better out of the inner corners than out of the outer corners of the eyes; this was more noticeable in the right eye. For about fifteen or twenty years she had had infrequent headaches which had incapacitated her for a day or two, but she had had none recently. Her general health had been good and she had had numerous general examinations without finding a definite cause for her trouble. All her teeth had been removed. The physician who referred her to the Clinic reported bitemporal hemianopsia; vision in the right eye ability to count fingers at 10 inches in the nasal field; vision in the left eye 20/100; fundus negative. The patient has mild glycosuria.

The general examination revealed blood-sugar 0.136 per cent and no diabetes. The Wassermann tests on the blood and the spinal fluid were negative; there were 9 lymphocytes in the field. Roentgenograms of the skull were negative. The metabolic rate was -3 per cent. Vision in the right eye was recorded; ability

to count fingers 2 feet in the nasal field vision in the left eye 6/20. The pupils were equal and reacted somewhat sluggishly. On the examination of the media in the right eye a few floating vitreous opacities were noted the nerve head was round of good color perhaps slightly pale in the temporal half in the left eye the media were clear the nerve head round, rather pale in the temporal half, with perhaps a slight loss of substance. The pallor of the disks was not sufficient to be typical of pituitary tumor. The visual fields showed bitemporal hemianopsia with

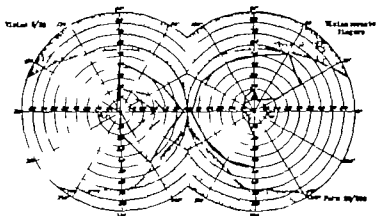


Fig. 578.—(Case A342 936) December 6, 1920. Right eye loss of part of the superior temporal quadrant and all of the inferior temporal quadrant, including the macular region no recognition of colors. Left eye temporal hemianopsia no recognition of green.

preservation of the upper outer quadrant in the right eye, loss of vision for all color in the right eye and loss of vision for green in the left eye (Fig 578). The neurologic examination revealed slight weakness of the left fifth nerve and apparently slight weakness of the left seventh nerve around the mouth the deep reflexes were slightly increased. A diagnosis of brain tumor near the chiasm was made not typical of pituitary tumor. The patient was dismissed December 18th without operation.

April 5 1921 the patient returned to the Clinic. Examination of the eyes showed vision of the right eye 1/30 nasally vision of

the left eye 6/60. The fields showed a bitemporal hemianopsia with loss of vision for green color in both eyes. The fundi were not changed (Fig 579). Neurologic examination at this time did not show any material change in the findings. The spinal fluid was negative. The Nonne test was positive there were two small lymphocytes to the field. The Wassermann reaction on the blood of the husband was negative. Exploration of the chiasmal region seemed to be indicated.

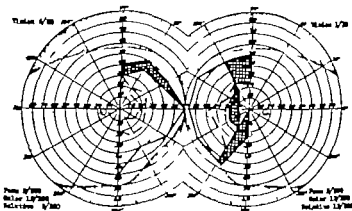


Fig 579—(Case A342,934.) April 5, 1921. Right eye: temporal hemianopsia, including the macular region. The relative field does not extend into the temporal half. Left eye: complete temporal hemianopsia. Its division of the macular region and slight relative field in the superior nasal quadrant. No recognition of green in either eye.

April 12th the chiasmal region was explored (Dr Adams). A tumor was exposed, granular in appearance, situated between the optic peduncles. Apparently it had broken through its capsule and extended in the sella from behind and underneath the base of the brain. It was purplish red and extremely fibrous.

Fifty milligrams of radium was buried in the growth for twenty-four hours. The patient's convalescence was uncomplicated except for restlessness. The pathologists reported endothelioma.

May 5th the eyes were examined. Vision in the right eye

was 6/60 in the left eye 5/60. The pupils were equal, the reflexes normal. The fundus of the right eye was normal. In the left eye the nerve head was pale without loss of substance otherwise it was negative. The fields showed improvement with return of vision for all colors, but a persisting bitemporal hemianopsia (Fig. 580). The neurologic examination at this time did not reveal changes.

The marked pallor of the left nerve head with the slight loss of substance and the first field, which shows the loss of the lower temporal quadrant with preservation of a sector of the upper

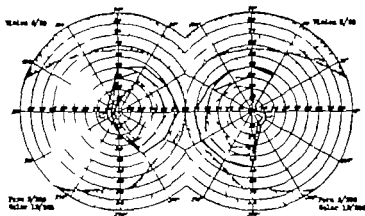


Fig. 580.—(Case A342,936.) May 4 1921. After exploration of endo-sella of the chiasmal region. Bitemporal hemianopsia, not including the macular regions.

temporal quadrant, led us to believe that the tumor in this case was not of pituitary origin.

CASE IV (A346 907)—Mr S W aged thirty-seven years, was examined January 20 1921 chiefly because of severe headaches in the left frontal region which had persisted for fifteen years each attack had lasted for from one to two hours the pain had varied from a dull to a very sharp pressing type. It had been worse in the daytime. For the past six years he had vomited once or twice during a month without nausea. Five years before examination he had had to give up tailoring because of

trouble with his vision. He had used glasses for twelve years with success until the last five, since when his vision had failed gradually glasses had not improved it. In 1918 the eyes had revealed a left homonymous hemianopsia since then the eyes had gradually failed with a persistence of headaches with nausea.

The general examination revealed an essential hypertension the systolic blood-pressure was 220 the diastolic 138. The ear, nose, throat, and nasopharynx were negative the Wassermann reaction on the blood was negative. Roentgenograms of the

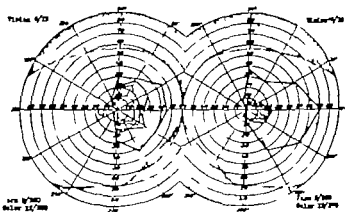


Fig. 581—(Case A346,907) January 21, 1921 Left homonymous hemianopsia with contraction of the fields for form and color of both eyes.

head showed the sella turcica to be greatly enlarged, with destruction of the posterior clinoid processes. The metabolic rate was -17 per cent. Vision in the right eye was 6/30 with correction, in the left eye 6/15 with correction. The pupils were equal and reacted normally. The cornea and media were clear. The fundi showed pallor of both disks without exudation there was no loss of substance and no evidence of previous swelling of the disk. The macular regions were negative. The perimetric fields showed a left homonymous hemianopsia (Fig. 581). Neurologic examination was practically negative except for a public distribution of hair feminine in type and slight loss

of strength. Intelligence and co-operation were slightly below normal. A diagnosis of questionable pituitary tumor was made.

A right subtemporal decompression was performed for exploration of the tumor (Dr Adson). A purplish gray tumor was found situated underneath the brain stem posterior to the optic commissure involving the brain posterior to the commissure but the optical peduncle and commissure in front were perfectly free and not stretched. On account of the extent and position of the tumor further surgery was not advisable.

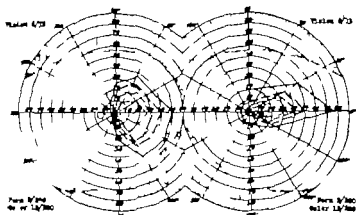


Fig 582.—(Case A346,907) February 5, 1921 Condition after right subtemporal decompression. Left homonymous hemianopsia with contraction of the fields for form and color of both eyes.

The patient convalesced uneventfully and the wound healed by primary intention. Postoperative neurologic and eye findings were the same as before operation except that the fields were slightly more contracted (Fig 582)

CASE V (A358,995) —Mrs. W V D aged forty five years was examined May 23 1921 because of poor vision. About six months before she had begun to notice that her eyesight was poor she had been unable to see objects until they were almost in front of her especially on the left side. She had had slight dizziness for the last two weeks, without headaches, but with a slight tendency to nausea. She had felt well generally and had

trouble with his vision. He had used glasses for twelve years with success until the last five since when his vision had failed gradually—glasses had not improved it. In 1918 the eyes had revealed a left homonymous hemianopsia since then the eyes had gradually failed, with a persistence of headaches with nausea.

The general examination revealed an essential hypertension the systolic blood-pressure was 220 the diastolic 138. The ear nose, throat, and nasopharynx were negative the Wassermann reaction on the blood was negative. Roentgenograms of the

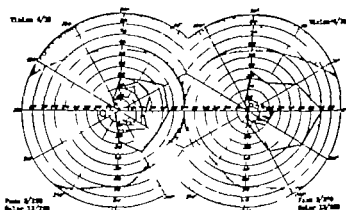


Fig. 581—(Case A346,907.) January 21, 1921. Left homonymous hemianopsia with contraction of the fields for form and color of both eyes.

head showed the sella turcica to be greatly enlarged, with destruction of the posterior clinoid processes. The metabolic rate was -1 per cent. Vision in the right eye was 6/30 with correction, in the left eye 6/15 with correction. The pupils were equal and reacted normally. The cornea and media were clear. The fundi showed pallor of both disks without excavation there was no loss of substance and no evidence of previous swelling of the disk. The macular regions were negative. The perimetric fields showed a left homonymous hemianopsia (Fig. 581). Neurologic examination was practically negative except for a pubic distribution of hair feminine in type and slight knee

extremely fibrous. The tumor which was about 5 cm. in diameter was coming from the arachnoid and pressing the left optic peduncle down and outward and the right optic peduncle outward. By careful dissection the entire tumor was removed and the sella was left undisturbed. The pathologist's diagnosis was psammoma, meningeal tumor.

The patient reacted normally and was conscious and cheerful the night after the operation. At 2 A. M. she became unconscious, the pulse became irregular and she threw her hands around

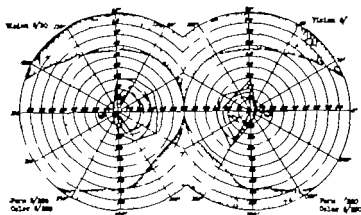


Fig. 584.—(Case A358,995) May 24, 1921. Condition practically the same as that in Fig. 583.

wildly. She died suddenly the afternoon of the second day. Necropsy was refused.

CASE VI (A362,271)—Mr H. C. a farmer aged twenty-nine years, came to the Clinic June 21, 1921 complaining of loss of vision in the left eye and failing vision in the right eye. The past history was negative except for an attack of influenza in 1918 followed by a good recovery. In 1917 the patient had noticed that his vision was poor in the left eye and had consulted an oculist, who gave him glasses without any improvement in the vision. This examination had revealed lost vision in the left eye and poor vision in the right.

not lost weight. Two weeks before she had had a spinal puncture with resulting pain across the hips and back. The roentgenographic report sent with the patient was erosion of the sella.

A general examination of the patient was negative. The Wassermann reaction on the blood was negative. A roentgenogram revealed the sella to be normal in size and contour. The blood and urine were negative. Vision in the right eye was 6/6, in the left, 6/30 the pupils and reflexes were normal. The fundi showed slight pallor of the nerve head without loss of substance in the right eye, and marked pallor of the nerve head without

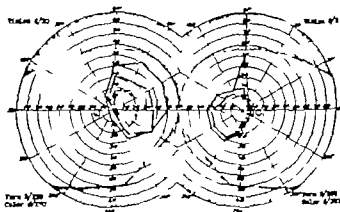


Fig 583 —(Case A358,995.) May 19 1921. Bitemporal hemianopia. No contraction of the nasal fields for form and color of both eyes

loss of substance in the left eye. The fields showed bitemporal hemianopia with loss of vision for green (Figs. 583, 584). The neurologic examination was negative except for a slight diminution of the abdominal reflexes. A probable pituitary tumor was diagnosed.

May 31st, an operation was performed (Dr. Adson). A granular encapsulated tumor was found resting on the optic commissure, pushing out the right optic peduncle and concealing the left optic peduncle. The capsul was opened but the tumor could not be enucleated as is usually possible in cases of ordinary pituitary tumor. Tissue was removed which proved to be

right lateral ventricle was drained and about 45 c.c. of cerebrospinal fluid escaped. The right frontal lobe was elevated and the sella exposed. The optic chiasm was found to be pushed backward and upward by a tumor which arose from the base and involved the sella. It was definitely encapsulated, 4 by 3 cm. in diameter and bluish gray. On splitting the capsule between the optic peduncles a very pulpy cellular content and some blood escaped. Fifty milligrams of radium in a rubber tube was inserted for twenty four hours. The pathologist's report was cellular glioma.

The patient died August 3d, and necropsy revealed a glioma of the left temporo-sphenoidal lobe, coming forward and involving the sella, and hyperplasia of the thymus and lymphoid tissues.

The marked simple optic atrophy in this case although the other ophthalmologic findings could have been of pituitary origin, led us to believe this to be an extrasellar growth.

SUMMARY

1 Primarily all of the patients in the series came to the Clinic because of failing vision or complete loss of vision in one or both eyes.

2 Definite ophthalmic lesions were found in all the patients at the time of examination in the Clinic, while only 2 showed definite neurologic changes.

3 In 4 of the patients the ocular changes could not be distinguished from those characteristic of a pituitary syndrome, which shows the necessity of careful examination of the fields and fundus early in the course of the disease in order to detect the progressive changes. This would have been of great advantage in the preoperative diagnosis in the 4 cases which were not distinguished from pituitary tumor.

4 Only one of the patients (Case A298,594) gave a history of changes in menses. She had uterine fibroids which had been treated by radium.

5 None of the 6 patients had any evidence of acromegaly and in 4 of the cases in which the metabolic rate was estimated it varied from -3 to -27 per cent.

The general examination showed periapical infection of seven teeth. June 30th the basal metabolic rate was -27 per cent. and July 14th -15 per cent. The blood-sugar was 0.11 per cent. The roentgenogram of the sella turcica showed a moderate enlargement, but it was otherwise negative. The vision of the right eye was 6/30 fingers could be counted with the left eye. There was marked blepharospasm with photophobia and slight drooping of the lids. The pupils were equal and reacted normally. The media were clear. The fundi showed marked simple atrophy.

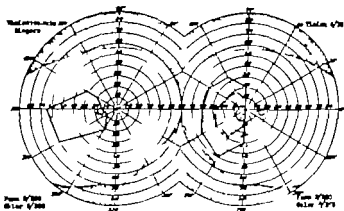


Fig. 585.—(Case 1362,271) Right homonymous hemianopsia with contraction of the form fields. N. recognition of green in the right eye. No recognition of colors in the left eye. N. relative fields with 15° test object.

of both nerve heads with loss of nerve substance the margins were distinct and the lamina cribrosa were plainly seen. The macular regions were slightly granular. The perimetric field revealed right homonymous hemianopsia (Fig. 585). We believed that this was uprosella growth as the foci were not typical of pituitary growths. The neurologic examination was negative except for the eye findings, and diagnosis of probable pituitary tumor was made.

August 2, 1921 operation was performed (Dr. Adson). The

OBSERVATIONS IN THE MANAGEMENT OF CHRONIC FRONTAL SINUSITIS WITH EXTERNAL MANIFESTA- TIONS: REPORT OF 22 CASES

HAROLD I. LILLIE

RECENT medical literature dealing with chronic suppurative frontal sinus disease manifests an ultraconservative tendency. My position with regard to the treatment of this condition is in accord with the opinions of Eagleton¹ and Conkley,² namely that certain cases require drainage and others require operation.

In advising an external operation the physician has in mind the eradication of the disease process for the relief of symptoms. In accepting the advice the patient has in mind the possibility of facial asymmetry or perhaps deformity and the fact that previous conservative measures have not sufficed to relieve the symptoms. That there is some danger is apparent, but the danger is no greater than that which any major operation entails.

A cure, *restitutio ad integrum* cannot be said to have been accomplished because of the necessity of interfering with the physiologic function and the anatomic relations. However relief of symptoms from the patient's standpoint is accomplished.

MATERIAL STUDIED

The material for this study consists of 22 cases observed in the Mayo Clinic, 2 in 1917 3 in 1918 6 in 1919 and 11 in 1920. All the patients presented themselves at the Clinic with external manifestations of diseased frontal sinuses. Sixteen had discharging fistulas 5 had subperiosteal abscesses and 1 had evidence of a mucocele. All but 4 patients had had some extra nasal operation performed. In several the frontal sinus could be entered readily through the nose. In no instance however had a really so-called radical operation been performed. The

6 Four patients died and 2 necropsies were obtained. Nothing has been heard from the remaining 2 with regard to changes in vision and fields.

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Fig. 586



Fig. 587

operations had been about equally performed by general surgeons and by specialists in diseases of the nose and throat. This fact is significant.

CLINICAL OBSERVATIONS PREVIOUS TO SURGICAL INTERVENTION

Before deciding to perform the external operation it has been customary carefully to observe patients and to make use of all available intranasal and therapeutic diagnostic measures. Roentgenograms were taken particularly to show the conformity and size of the sinuses. In 3 instances the pathologic condition was definitely shown. In 1 the frontal sinus was filled with bismuth paste (Figs. 586-587) and in 2 sequestra were shown. A lateral view will reveal the depth of sinus, and the patient should be frankly told that there is more danger of deformity in the deep type. This did not, however, deter our patients from accepting the advice of a radical operation; they were apparently thoroughly discouraged with the results of conservative measures.

OPERATIVE INTERFERENCE

Our early experience has shown that the most formidable part of an external operation is the intranasal, because of the bleeding and the inversion of the anatomic relations to what one is more accustomed. Late in 1919 a two-stage operation was decided on in such cases. Under local anesthesia the nasofrontal duct was enlarged, and the nasofrontal ethmoids and anterior ethmoids were carefully exenterated. In fact, if multiple sinusitis were present, an effort was made to perform as much as possible of the operation intranasally (Fig. 588). Important details were found to be the flattening of the lateral wall anterior to the anterior end of the middle turbinate in the upper nasal cavity in smoothing off the rough edges (this is best accomplished by a hand burr) and the careful removal of all shreds of membrane. The latter procedure has tended to lessen the formation of the granulation tissue that ordinarily fills the nasofrontal region in these cases.

In 3 cases the intranasal operation proved to be sufficient to effect relief of all symptoms. In 1 of the 3 it was necessary to



Fig. 589.—(Case A347 751.) *A* Artificial nasofrontal duct. *B* break in supra-orbital wall by pyrocele.

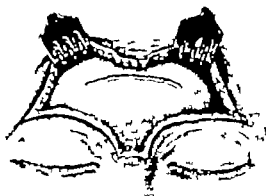


Fig. 590.—Beck's lockman

make an artificial nasofrontal duct (Fig. 589). Occasionally it was necessary to correct a widely deflected septum before the first stage of the operation could be accomplished.

As a general rule the external operation was instituted within a week or ten days after the intranasal operation. Modifications of the Killian operation, to suit the case in hand were used. General anesthesia was used in most instances, but good nerve-blocking anesthetics are preferable in selected cases.



Fig. 588.—Intranasal procedure in frontal sinus operation.

The choice of the incision depends on the size and conformity of the frontal sinus. If the intranasal stage of the operation has been accomplished satisfactorily the incision should be carried just above the eyebrow or just below it, since this causes much less scarring—that is, there will be no scar to separate or divide the eyebrow. In closing the wound nicks may be made in the skin to aid in the proper approximation. The incision may be

left for the final part of the operation, which is readily accomplished because of the previous intranasal operation. A lateral frontal ethmoid cell just below the dense bone of the nasoseptal side is looked for and frequently encountered. This has been brought out also by Conkley. In case a double frontal has been performed, the nasofrontal duct regions are joined somewhat after the method suggested by Lathrop. This procedure has

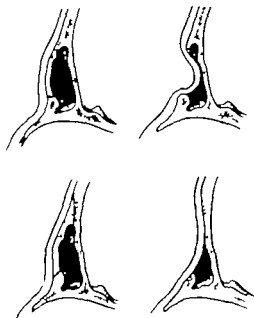


Fig. 592.—Diagrams showing beveling of bone edges to avoid pocketing.

been used in 3 cases with good results. There is less tendency for the formation of granulation tissue. The orbital ridge is taken down rather more than would seem indicated particularly in the larger deep sinuses to allow less apparent depression. I am not ready to accept the suggestion that any external operation should include both sinuses, whether or not the other is diseased, even though the deformity will be less apparent.

Vaseline gauze strips protruding from the nose are used for

carried laterally as far as is indicated. If it is found that the sinus extends well up toward the hair line, or is larger than its fellow spreading past the midline, or if it is necessary to perform a double operation, I prefer to use the incision suggested by Beck (Fig 590). Vertical incisions in unilateral cases always leave scars (Fig 591).

To be sure of eradicating any disease presupposes sufficient exposure. The initial removal of the outer table of the frontal sinus is accomplished by the use of a gouge. Rongeurs are then employed to remove the outer table and to bevel the upper and lateral extremities. This latter procedure is important in avoiding the obviousness of postoperative deformity by not



Fig. 591.—Hayek's incision

allowing abrupt angles for the soft parts to fall over. It also avoids infected pockets (Fig 592). Constant use of the probe for finding pockets is advantageous. Pocketing and overhang defeat the purpose of well-intended surgical procedures dealing with disease processes involving bone. Careful smoothing of the inner table with removal of mucous membrane is important. Avoidance of the use of the gouge on the inner table to lessen the danger of fracture, is important. Scarification of the under surface of the periosteum insures better coaptation.

The superior wall of the orbit is removed as far as is necessary in order to uncover any lateral ethmoid cells which are frequently found, if looked for. The nasofrontal duct region is

formed the operation for specific ostentis of the frontal bone which was found to extend into the frontal sinus. Because a probe could be passed through the nasofrontal duct from above downward he believed that drainage was sufficient. As the process did not respond well, even under intensive antispesific treatment, the external frontal sinus operation was performed. This revealed a sclerosing reparative process including several lateral actively infected pockets. Following the external operation the healing was rapid and complete.

One frontal sinus was filled with bismuth paste. The intra nasal operation permitted the removal of a portion of the paste, but as the roentgenogram showed that all had not been removed, the external operation was performed (Figs. 586-587). An infected pocket, lateral to the bismuth paste was found it accounted for the persistent trouble of which the patient complained. Two cases showed sequestration in both of these there had been severe injury followed by infection. To leave the periosteum over the strip of bone for support of the soft parts has not seemed important.

In one case the disease process had uncovered the dura. The bone was removed until the healthy dura was exposed with satisfactory results. One patient with an external fistula through the left side who had had two external operations was found to have a pansinusitis on both sides. The right side cleared up with the intranasal portion of the operation the left side required the external operation.

POSTOPERATIVE COURSE

After the patient has recovered from the anesthetic the sitting posture is preferred because the patient is more comfortable. We have found that removal of the external dressing after the second or third day lessens swelling and hastens healing. The intranasal packing can be removed on the third or fourth day. In none of our cases was it necessary to repack. Patients should not be allowed to clear the nares by blowing the nose.

The sutures may be removed the day following the removal of the packs. As a matter of fact, little after-care is indicated

packing. Cigarette drains have been discarded because one was torn by a bone spicule, necessitating opening the outer wound



Fig. 593—Closure of wound without external drainage

for its removal. The wound is closed with interrupted silkworm-gut sutures to insure strength and eversion of the lips of the wound (Fig. 593). Continuous dermal sutures close the skin.

PATHOLOGIC CONDITIONS

In all the cases in which operation had been performed elsewhere, bony overhang producing pockets filled with infected granulations was encountered. In no instance had the disease process been sufficiently exposed. It was probably hoped that drainage would clear up the condition, as extranasal packs had been used in all cases of fistula. In 5 cases in which operation had been performed pressure necrosis had caused a break through the outer table, in 3 into the orbit, and in 2 over the forehead. All the orbital cases without fistulas responded to the intranasal stage of the operation. In 3 instances a definite hypertrophic osteitis was encountered probably the same type of process that occurs in chronic mastoiditis.

Necrosis with softening of the bone as the result of the disease process was frequently encountered. All apparent diseased bone was radically removed. In one case general surgeon had per-

postoperative course other causes should be ruled out before the operative field is considered to be the cause.

There were 4 cases of diplopia. Three (Fig 589) were post operative and cleared up in one week these were earlier cases in which the one-stage operation was performed. The fourth case was an orbital pyocoele which produced proptosis the disease cleared up but the diplopia persisted. The patient stated that this did not trouble him.

Three patients had well-marked chemosis. The one-stage operation had been performed for all the patient in whom the chemosis was most marked had had the peri-orbita injured at operation. Care in handling the orbital contents is very essential, and subsequent to this case has seemed to be the means of avoiding the chemosis.

Meningitis occurred in a patient in whom both sides were involved and in whom a hypertrophic osteitis of the inner table was encountered. Necropsy showed that the inner table had been fractured and the dura injured. There was no external evidence of course since in such a case the inner table would appear negative whereas the inner surface would gape. Had this been recognized, I believe that uncovering the dura might possibly have prevented the death of the patient. One patient, several weeks after healing had occurred, developed a lung abscess but this cleared up finally under general care. The cause of this complication cannot be definitely determined, but probably it was due to metastasis.

APPARENT REASONS FOR THE DEFEAT OF PREVIOUS OPERATIONS

It seems apparent that insufficient exposure, failure to obliterate the diseased pockets, and leaving a bony overhang were important factors in the failures. Non-removal of the supra-orbital wall has a tendency to cause granulation in the nasofrontal duct region which the smooth surface of the peri-orbita seems to avoid. Exposition and exenteration of the lateral ethmoid cells are very important points this was demonstrated in 2 of our earlier cases in which the second operation revealed

other than the mechanical cleansing of the nares, preferably with an antrum cannula attached to a suction apparatus (Fig. 594). This avoids trauma of the membrane. Lavage is used only occasionally because of the tendency to "water-log" the



Fig. 594 —Antrum cannula.

membranes. Ventilation by air is helpful. In the final stage of resolution when crusting takes place the patient's use of liquid vaselin is helpful in the mechanical removal of the crusts.

COMPLICATIONS

Nearly all the patients had a slight rise in temperature for few days, particularly until the intranasal packing was removed. One patient had a chill and a rise of temperature to 104° F. but after the removal of the pack no further incident occurred. Three patients developed tonsillitis. With the occurrence of a febrile

CLINIC OF DR GORDON B NEW

CASE I RHINOPHYMA CASE II RHINOSCLEROMA

CASE I (A342,802) —Mr W J S a race-track gambler aged sixty years came to the Clinic December 4 1920 on account of a huge growth on the tip of the nose which had started eighteen years before. The patient was a very heavy drinker. He had noticed the enlargement for the first time after being drunk for



Fig 595



Fig 596

Figs 595, 596 —(Case A342,802.) Rhinophyma of eighteen years duration before treatment

three weeks. The enlargement had gradually increased. The only treatment had been local application. He had had syphilis thirty-five years before, but had not been treated.

Examination revealed an irregular soft nodular tumor about 4 cm in diameter extending from and involving the tip of the nose. Both alae were thickened and freely movable. The appearance is typical of rhinophyma (Figs. 595-597)

this to be the cause of our failure. The use of external drainage is not necessary and is too liable to cause more scar and, what is worse, fistulas. There is no one operation that is suitable for all cases.

I am of the opinion that more careful obliteration of the disease process, and beveling the bone angles so that the soft parts will not form patent pockets, are important factors in the success of the operation from the curative and cosmetic standpoints. I feel sure that meddlesome postoperative attention often defeats well-directed surgical procedure.

CONCLUSIONS

1. A two-stage operation has many advantages in the management of frontal sinusitis with external manifestations.
2. The external operation requires good exposure, careful elimination of pockets, and the leveling of bone edges.
3. Vertical incisions for exposure should be avoided.
4. The incision suggested by Beck is preferable for exposure of a large single sinus or of both sinuses.
5. External drainage is not necessary.
6. Early removal of the external dressing adds to the comfort of the patient and diminishes reaction and swelling.
7. Little after-treatment is necessary.

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observers recommend skin-grafting following decortication, but it is only necessary to pare off the tumor by means of a knife or a pair of scissors to the desired size. The index-finger of the left hand should be inserted into each nostril as required to prevent paring through into the nose. Usually there is a great deal of oozing, but this is readily controlled by the application of hot compresses and a vaselin dressing. The following day the dressing is removed, the wound is left open to the air and heat is applied by means of an electric light bulb to dry the secretions. In a few days little islands of epithelium will be noticed over



Fig. 598.—(Case 342,802.) Patient shown in Figs. 595-596 (after treatment

the denuded area. These are formed from the cut ends of the hypertrophied ducts and usually in the course of two weeks the raw surface is fairly well covered with epithelium. The cosmetic result is all that could be desired (Fig. 598).

CASE II (356,595).—Mr. D. K., aged twenty-seven years, an unmarried farmer born in Russia, came to the Clinic for examination May 2, 1921, because of enlargement of the nose and nasal obstruction. The condition had been noticed one year before following an injury by a kick from a horse. The injury did not seem severe; there was no external bruising. Soreness, a gradual swelling of the nose, a foul discharge, and gradual

A syphilitic lesion, tertiary stage, on the left hand was treated before the operation, which was performed January 3 1921 under ether anesthesia. The huge tumor was pared from the nose by means of knife and scissors. There was considerable oozing which was stopped by hot compresses. A vaselin dressing was applied. A day or two after the operation the wound was



Fig. 397.—(Case A254,911.) Photomicrograph of rhinophyma.

exposed to the heat of an electric bulb for the purpose of decreasing the secretion. In two weeks the raw area had almost entirely healed.

Comment.—In 1919 I published an article drawing attention to the fact that rhinophyma should be treated by decortication. Various other methods of treatment, however, are still in use. Types of flaps and skin incisions have been advocated and some

size, measuring about 6 cm. across. The meati were occluded almost entirely (Figs. 599-600). The soft palate was pulled up into the nasopharynx, but was not ulcerated. The nasopharynx was concentrically contracted with areas of granulomas but no ulceration. The condition was diagnosed rhinoscleroma on the clinical, the bacteriologic, and the microscopic examination of tissue (Figs. 601-602).



Fig. 601—(Case A356,595) Rhinoscleroma note intracellular micro-organisms.

Treatment.—Radium was used. The first series of treatments was given between May 11th and May 13th. A 50 mg tube of radium, with the container only as screening was inserted into either nostril for four hours each. On a nasopharyngeal applicator 50 mg was inserted into the nasopharynx for six hours. In June similar treatment was given in both nostrils, and July

obstruction to breathing developed. There was very little enlargement externally until within the last six months.



Fig. 600.

Fig. 599 600.—(Case 136,593) Rhinocystercoma of one year duration before treatment.



Fig. 599

Examination revealed granulomatous masses, which filled both nostrils. The nose was about three times its normal

22d the nasopharynx was treated for four hours by a 66 mg tube of radium. The improvement has been striking. The huge tumor has shrunk, leaving a very good cosmetic result. The condition is clinically cured (Fig. 603).

Comment.—Rhinoscleroma is a granulomatous neoplasm which affects the nose, nasopharynx, larynx, and trachea, and is due to a micro-organism similar to if not the same as, the bacillus of Friedländer. At one time the condition was limited to the inhabitants of Central Europe. It now seems to be more wide-spread throughout the world. All cases in this country in my investigation of the literature previous to the publication of an article by Watkins in 1921 were of foreign-born persons.

The x-ray and radium seem to offer the best chance of cure in these cases, but since the former is not applicable in the treatment of a lesion in the mucous membrane the use of radium is preferred. Vaccine salvarsan caustics and so forth, have been used but without definite results. This is the third case in which I have used radium. All the results are striking.

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Fig. 602.—(Case A356,595.) Culture of organism from rhinoscleroma.



Fig. 603.—(Case A356,595.) Patient shown in Figs. 599-600 after treatment.

EPITHELIOMA OF THE EAR: A STUDY OF 63 CASES

ALBERT C. BROUERS

No one should attempt a prognosis with regard to a neoplasm without knowing something of its macroscopic nature, its size, and its location. In this series of 63 patients three types of epithelioma from the protective epithelium of the ear were encountered, namely basal-cell epithelioma or rodent ulcer (Figs. 604, 605) squamous-cell epithelioma (Figs. 606-609) and



Fig. 604 —(Case A71,769) Basal-cell epithelioma of the cheek.

melano-epithelioma (Figs. 610-611) While all of these epitheliomas are cancers, there is a great difference in the effect they produce on the patient. It is well known that basal-cell epithelioma is the least malignant and melano-epithelioma the

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most malignant of the three the squamous-cell epithelioma is graded between the two. In an article on squamous-cell epithelioma of the lip I divided the epitheliomas into four groups, according to degrees of cellular activity based for the most part on differentiation. Keratinization or pearly body formation was considered complete differentiation. If an epithelioma showed a marked tendency to differentiate, that is, if about three-fourths of its structure was differentiated epithelium and



Fig. 607—(Case G251.) Squamous cell epithelioma of the ear Grade 2

one-fourth undifferentiated epithelium, it was graded 1. If the differentiated and undifferentiated epithelium were about equal, it was graded 2. If the undifferentiated epithelium formed about three-fourths of the growth and the differentiated about one-fourth it was graded 3. If there was no tendency of the cells to differentiate it was graded 4. The number of mitotic figures and cells with single large deeply staining nucleoli (undifferentiated cells) plays an important part in the grading. The Grade



Fig. 605.—(Case A45,739) Basal-cell epithelioma of the ear



Fig. 606.—(Case A237,504) Squamous-cell epithelioma of the ear Grade 1

were located on the auricle, 14.28 per cent. in the external auditory canal, and 1.58 per cent. in the middle ear (Figs. 612-613). Forty and eighty-one-hundredths per cent. of the lesions in the auricle were located primarily on the helix, 28.57 per cent. on the concha (anterior and posterior surface) 18.36 per cent. on the lobe, 6.12 per cent. on the scapha 4.08 per cent. on the triangular fossa, and 2.04 per cent. on the tragus.



Fig. 609 —(Case 4182,497) Squamous-cell epithelioma of the ear Grade 4.

Thirty-nine and sixty-eight hundredths per cent. of the patients had had non-surgical treatment, 28.57 per cent. had had surgical treatment, and 53.68 per cent. had had a combination of treatments before entering the Clinic.

Of the 63 cases 56 were operable and 7 were inoperable. In 92.85 per cent. of the 56 operable cases treatment was surgical, and in 7.14 per cent. radium alone was used. In 46.15 per cent. of the cases treated surgically radium treatment also was employed and in 3.84 per cent. x-ray treatment also was employed.

4 squamous-cell epithelioma corresponds in malignancy very closely to the melano-epithelioma, while the basal-cell epithelioma is slightly less malignant than the Grade 2 squamous-cell epithelioma.

Of the 63 patients in the series, 76.19 per cent. were males and 23.80 per cent. were females; the average age was sixty-one and one-fourth years. Sixty-four and forty four-hundredths per



Fig. 608.—(Case A193,459) Squamous-cell epithelioma of the ear. Grade 3

cent. of the males were farmers. Nineteen and four-hundredths per cent. had a family history of malignancy. 63.49 per cent. had a history of a previous wart, mole, seborrheic keratosis, ulcer, eczema, pimple, or lump at the site of the lesion. 19.04 per cent. had a history of injury or infection. The average duration of the lesion was 4.11 years; the average maximum diameter was 3.22 cm. Eighty-four and two e-hundredths per cent. of the lesions

In 42.85 per cent. of the 7 inoperable cases x ray treatment was employed, and in 14.28 per cent. radium treatment.

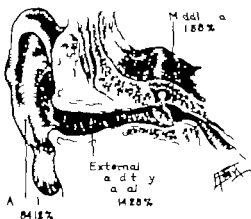


Fig. 612 — Percentage of location of lesions.

Sixty-one and ninety-hundredths per cent. of the epitheliomas in this series are of the squamous-cell type 33.33 per cent. are of the basal-cell type, and 4.76 per cent. are of the melanotic

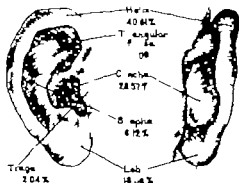


Fig. 613 — Percentage of location of lesions on the auricle.

type Of the squamous-cell epitheliomas, 5.12 per cent. are of Grade 1 66.66 per cent. are of Grade 2 23.07 per cent. are of Grade 3 and 5.12 per cent. are of Grade 4.



Fig. 610.—(Case A158,771.) Melano-pithelioma of the ear

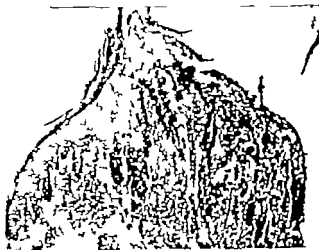


Fig. 611.—(Case A160,912.) Melano-pithelioma of the calf of the leg

In the cases of melano-epithelioma 100 per cent. poor results followed treatment.

In the cases of basal-cell epithelioma 58.33 per cent. of the patients are alive with good results, 25 per cent. are alive, with fair results, and 16.66 per cent. are dead, with poor results.

In the cases of squamous-cell epithelioma 45 per cent. of the patients are alive, with good results 20 per cent. are alive, with fair results, and 35 per cent. are dead with poor results.

In the cases of squamous-cell epithelioma in Grade 1 one patient (50 per cent.) died the result of treatment is not known in Grade 2 50 per cent. are alive with good results, 25 per cent. are alive with fair results, and 25 per cent. are dead, with poor results in Grade 3 42.85 per cent. are alive, with good results 14.28 per cent. are alive with fair results, and 42.85 per cent. are dead, with poor results in Grade 4 100 per cent. are dead with poor results.

In the cases with metastases 100 per cent. poor results were obtained in the cases without metastases 100 per cent. good results were obtained, and in cases in which no regional lymph-nodes or salivary glands required removal (all squamous-cell epitheliomas) 53.33 per cent. of the patients are alive, with good results, 26.66 per cent. are alive with fair results and 20 per cent. are dead, with poor results.

In the cases of lesions in the auricle 51.61 per cent. of the patients are alive with good results, 16.12 per cent. are alive, with fair results, and 32.25 per cent. are dead with poor results

In the cases of lesions in the external auditory canal 66.66 per cent. of the patients are alive with fair results and 33.33 per cent. are dead with poor results.

Results in connection with the size of the epithelioma are as follows large (4 cm. and over) 50 per cent. with good results, and 50 per cent. with poor results medium (2 cm. to 4 cm.) 38.46 per cent. with good results, 15.38 per cent. with fair results, and 46.15 per cent. with poor results small (2 cm. and under) 53.33 per cent. with good results, 33.33 per cent. with fair results, and 13.33 per cent. with poor results.

Of the 7 patients in whom the regional lymph-nodes were removed 85.71 per cent. had metastasis. The involvement of the regional lymph nodes and salivary glands found at operation was as follows: Parotid lymph-nodes, 50 per cent. external jugular nodes 50 per cent. parotid salivary gland, 33.33 per cent. submaxillary lymph-nodes, 16.66 per cent. superior deep cervical nodes 16.66 per cent., and inferior deep cervical nodes,

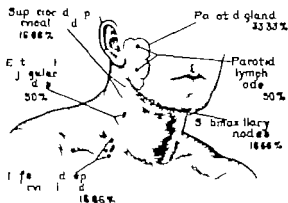


Fig. 614.—Percentage of location of metastasis.

16.66 per cent. most of the patients having involvement in more than one group of glands (Fig. 614).

RESULTS

Forty-seven and five hundredths per cent. of the patients are alive with good results. The average duration of life since the last or only operation or non-operative treatment, was 3.53 years. 20.58 per cent. are alive with fair results after an average duration of life of 5.44 years. 32.35 per cent. are dead with poor results, after an average duration of life since the last or only operation or non-operative treatment of 1.63 years. Four patients are dead whose results were not reported or who died too soon after the operation to be considered from the standpoint of good, poor, or fair results.

PRIMARY TUBERCULOUS PERICARDITIS

CARL A. HEDBLOM

TUBERCULOSIS is probably a much more frequent cause of pericarditis than is generally recognized. Bamberger in 1872 and later McPhedran state that next to rheumatic fever it is the most frequent cause. Even though a non-tuberculous pericarditis may occur in the presence of a tuberculous lesion elsewhere, it would seem probable that most cases of pericarditis that cannot be proved to be pyogenic are tuberculous. It is generally accepted that most cases of primary idiopathic pleurisy with effusion and of adhesive pleuritis are tuberculous. The analogy of the latent adhesive pericarditis found so often at necropsy and of the pericarditis with effusion in tuberculous persons is striking. Tuberculous pericarditis may become secondarily infected by pyogenic organisms, as in a case reported by Kob

Tuberculous pericarditis is usually secondary to a tuberculous lesion elsewhere in the body. At necropsy the most commonly found associated focus is of the mediastinal or tracheobronchial lymph-glands. Less often the lungs or pleurae are involved. In some cases the pericardial process is part of a general polyserositis or of a milary tuberculosis. Thym in a study of 94 cases in which detailed findings were given, found that there was pulmonary involvement in 53 milary tuberculosis in 22 and tuberculosis of other organs without pulmonary involvement in 14. In 5 the condition appeared to be primary in the pericardium.

The relative incidence of pericarditis in tuberculous patients is variously given. Osler found the pericardium involved at necropsy in 7 of 275 cases. Willgk noted 11 cases in 1317 necropsies. Wells in 1048 necropsies, found pericardial adhesions in 128. The process was acute in 71 and chronic in 57. Of the

Of the 7 inoperable cases, death is known to have occurred in 5. The location of the epithelioma in the 7 patients was as follows: in the auricle in 3 cases, in the external auditory canal in 3 and in the middle ear in 1.

could be made out either in lymph-glands or in organs. This makes a total of 13 cases.

HISTORY OF PATIENT OBSERVED AT THE MAYO CLINIC

CASE 358 127 —Mr H. A. aged thirty-six years, presented himself at the Mayo Clinic May 14 1921 complaining of dyspnea, an uncomfortable sensation in the precordium and slight edema of the legs. His wife had died of pulmonary tuberculosis one year before. In June 1920 the patient had had an attack of sore throat with fever and felt weak and listless afterward. In July a roentgenogram showed a large cardiac shadow characteristic of pericarditis with effusion. He was in bed two months following this, during which time phlebitis developed in both legs. There was no appreciable change in the pericardial condition. In August his afternoon temperature had been 100° to 101° F. his pulse 120. He had noticed a slight loss in weight and strength, cold night-sweats pain at the costal margins and cough without sputum. Repeated physical examinations for pulmonary tuberculosis were negative. January 1921 he noticed a sense of weight in the left chest, with sharp knitting pains. February 29th, March 7th, and March 12th pericardial aspirations were performed (elsewhere) and a total of 2500 c.c. of fluid withdrawn. At the first two aspirations the fluid was clear at the third it had the appearance of pea soup.

Physical examination showed a limitation of the movements of the lower left chest and slight respiratory retraction at the apex, with obliteration of the cardiohepatic angle. The heart sounds were distant and rapid, but there were no murmurs or arrhythmia. The veins of the neck were engorged and the face cyanosed on recumbency. The systolic blood-pressure was 108 the diastolic 88 and the pulse-rate 110. Roentgen examination showed the heart to be enlarged to 26 by 16 by 10 cm. (Fig. 615). An electrocardiogram showed evidence of myocardial degeneration. Eight teeth showed periapical infection there was no evidence of focal infection elsewhere. A tentative diagnosis was made of tuberculous pericarditis with effusion, and pericardotomy was advised.

acute cases, 8 were proved to be tuberculous. Metcalf noted that the pericardium was involved in 5 per cent. of cases of active tuberculosis.

The occurrence of a primary isolated tuberculous pericarditis, apart from glandular or other lesions elsewhere, has been questioned, and by some categorically denied (Bamberger Schröter * Strumpell). There are however a few reported cases in which the most careful and painstaking search at necropsy has failed to reveal a trace of tuberculosis outside the pericardium. Orth states that such cases are apt to be found in old persons. Whether or not in such cases there may have been a minute lesion that was overlooked becomes a question of academic interest only. McPhedran states that it is becoming more and more generally accepted that the lymph-glands are always the seat of primary infection, and that the various tissues and organs subsequently infected are invaded by way of their lymphatic vessels. On this basis all cases of tuberculous pericarditis associated only with involvement of the mediastinal or tracheo-bronchial lymph-glands may be considered as primary. If *Bacilli tuberculosis* are present in glands that appear perfectly normal, as reported by Maragliani Romberg, Pizzini and Bartel, it would seem to indicate that a primary tuberculous process may develop in the pericardium through these lymph channels.

Rokitansky is credited with being the first to mention primary tuberculous pericarditis. He says that inflammation of pericardium often occurs in original combination with inflammation of the serous sac, and that it is usually associated with and dependent on an earlier tuberculous condition. Thoen in 1872 however states that it may be primary.

The first reported case of primary tuberculous pericarditis according to Voskov was by Quinquand and Lejard in 182. Thym in 189 cites 5 cases from the literature but 1 of these judging from the details given, was probably secondary. I have observed one case at the Mayo Clinic of proved tuberculous nature and clinically primary and have been able to collect from the literature cases in which at necropsy a tuberculous pericarditis was found, but in which no trace of tuberculosis

icularly at the apex but there was no arrhythmia, no systolic retraction, and Broadbent's sign was not present. A very large cardiac shadow could be seen in the roentgenogram. A pericardotomy was advised.

August 3d operation was performed under local anesthesia and gas and oxygen analgesia. The intrapericardial pressure was measured with a water manometer and found to fluctuate with respiration between 4 and 12 cm. of water pressure. About



Fig. 617 —(Case A358,127) T. tuberculosis of the pericardium ($\times 250$)

2000 c.c. seropurulent fluid was evacuated. The parietal pericardium and heart were covered with a whitish fibrinous membrane about 8 mm. thick and the pericardium itself was about 4 mm. thick. Repeated observations during the evacuation of fluid showed no change in blood-pressure. The wound in the skin and subcutaneous tissue was completely closed by suture but the pericardial incision, about 2.5 cm. long, was left open for dependent subcutaneous drainage.

The patient's convalescence was characterized by a regular

May 18th operation was performed under local anesthesia. The incision was made over the sixth rib the pericardium was opened, and about 2000 c.c. seropurulent fluid aspirated. The pericardium was explored for trabeculated cavities, but none was found. The patient did not experience pain when the unanesthetized pericardium was incised. The pericardium was 3 to 4 mm. thick, and both layers were covered with a thick coat of fibrin. The heart lay in the posterior portion of the sac. The

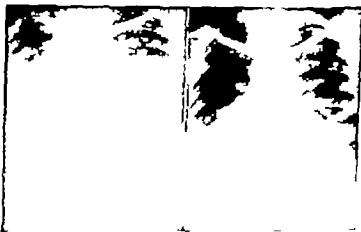


Fig 615

Fig 616

Fig 615.—(Case A358,127) May 14, 1921. Very large heart shadow.

Fig 616.—(Case A358,127) May 23 1921. Condition after pericardiectomy with evacuation of 2 liters of seropurulent fluid.

pericardium and superficial wound were closed without drainage (Fig 616). A specimen removed for diagnosis revealed tuberculous (Fig 617). Guinea-pig inoculation of the ex date gave negative result.

In July the patient returned to the Clinic for observation. He had gained 21 pounds since his operation but he was still short of breath, any effort caused dyspnea, and the thrombophlebitis of the legs was still present. The area of cardiac dullness extended 4.5 by 13 cm. and the sounds were very distant par

Cough without sputum and without obvious relation to other symptoms occurred in periodic attacks early in the illness. The patient left the hospital September 8th (Fig 618). The outlook for recovery seemed rather poor.

DISCUSSION

The clinical diagnosis of tuberculous pericarditis, made by Dr. Willius in this case, was based on the chronicity, the recurrence of effusion after three aspirations, the history of recent exposure to tuberculous infection and the absence of any other recognizable disease condition. The presence of a relatively large sterile effusion was also regarded as suggestive.

Differences of opinion have been expressed in the literature with regard to the relation of a large amount of exudate to tuberculosis. Rogers believes that a large serous effusion is characteristic of tuberculous. Bertaux collected 12 cases of secondary tuberculous pericarditis proved at necropsy in which effusions varied in amount from 1000 to 2200 c.c. Bérard and Péhu reported a case in which 2200 c.c. were aspirated, and emphasized the fact that the patient was able to walk about and was remarkably comfortable in spite of the large effusion. Musser and Ruschhaupt reported cases with about 3000 c.c. tuberculous exudate.

It seems probable that while a tuberculous exudate can and often does reach 1 or 2 liters it does not follow that a large exudate may not be non-tuberculous nor that an exudate of relatively small amount may not be tuberculous. The majority of cases of tuberculous pericarditis are of the adhesive type, without fluid.

Probably the reason that these patients tolerate a relatively large effusion when some patients have died from strangulation of the heart by a small amount of fluid (only 250 c.c. in Gluck's case) is that the chronic course has enabled the pericardium to stretch sufficiently to keep the intrapericardial pressure below the limit, causing serious embarrassment to the circulation. The presence of a large effusion with relatively slight disturbance from it, therefore points to a chronic course and tuberculous

pulse-rate of about 90 a moderate seropurulent discharge from the wound, at first intermittent and then decreasing which became purulent after one month a left serous pleural effusion which developed about three weeks after operation, the roentgenogram revealing a collapse of the left lung thrombophlebitis of the right jugular and subclavian veins, marked edema of the right hand and arm, upper chest wall, abdominal wall, and legs and dyspnea and cyanosis.



Fig. 618—(Case A358,127) September 10, 1921 Incision healed. Edema of the right hand and arm resulting from phlebitis.

September 1st, the twenty-ninth day after the second operation, thoracentesis was performed and 700 cc of clear serous effusion evacuated. The presence of pleural exudate obscured the Roentgen-ray findings, but as far as could be determined there was no marked increase in the pericardial effusion. The dyspnea, cyanosis, and general edema were considered due to myocardial weakness. Digitalis was followed by gastric upset and little or no myocardial response. It was therefore omitted. A salt free diet also was without apparent effect on the edema.

as a laparotomy often proves to be in a case of tuberculous peritonitis. The pericardiectomy in this case served to evacuate the exudate and the diagnosis of the tuberculous nature was established by the microscopic examination of the specimen of excised pericardium. A very marked immediate benefit resulted from the operation but it was ineffective in preventing recurrence of the effusion.

At the second pericardiectomy an attempt to secure drainage without the risk of secondary infection was made by instituting subcutaneous drainage after the method of Jacob. Study of the roentgenograms indicates that this procedure is at least partially effective. The collapse of the left lung may have been caused by an opening into the pleural cavity at the time of operation. No special precautions were taken to avoid this complication at the second operation inasmuch as the opening was made in the same area as at the previous operation, following which there was no pneumothorax. At the first operation the pleura were found to be thickened and apparently adherent, and it seemed reasonable to suppose that further adhesions would result. Further the absence of fluid in the pleural cavity for several days after the second operation is evidence that the pleural cavity was not opened at the operation. It is possible therefore that the pneumothorax may have developed from a lesion in the parenchyma of the lung. In any case the absence of symptoms attributable to pneumothorax at the time of the operation and the edema involving the right arm and neck, indicating a phlebitis of the jugular and subclavian veins, suggest that the patient's failure to improve may have been due in part to a dissemination of the tuberculous process. What part, if any the absorption of a tuberculous fluid into the subcutaneous tissues may have played it is impossible to say. Subcutaneous drainage seems to be a less hazardous procedure than open drainage which is almost sure to be followed by secondary infection. In the case reported by Jacob the cure followed closed drainage. In some cases cures follow open drainage (Meyer Gibson Rullier) but in most cases open drainage has been followed by death.

pericarditis with effusion is practically the only form that runs a prolonged, relatively *symptomless course*.

The effusion may be serosanguineous in the early stage, or it may be *unmixed* with blood, and rarely it is purulent from the onset. The blood is believed to come from the capillaries that appear in the organization of successive layers of fibrous deposits (Virchow) in some cases it may come from ulceration of the visceral pericardium.

Judging from the relative frequency at necropsy of pericardial adhesions of probable tuberculous origin in patients who have died of another disease, it is probable that a large proportion of patients with latent tuberculous pericarditis recover spontaneously. Most patients with a large amount of exudate, however run a chronic course and die. Surgical treatment is difficult. The fluid reaccumulates after aspiration. Open drainage is likely to be followed by secondary infection and the disease runs a characteristically downward course. In the case of secondary tuberculous pericarditis the course seems largely determined by the type and location of the primary lesion. Cases in which the primary condition is in the pericardium and which end in recovery cannot be positively diagnosed. In the cases of primary pericarditis herein recorded death was immediately due to the disease in 5 (Virchow Meltzer Marcoux, Noskov). In 2 (Seaghost, Frumberg) death appears to have been the result of an associated non-tuberculous disease of the kidney. A single aspiration was performed in only 1 of these cases. In the case observed in the Clinic pericardiectomy seemed indicated rather than further pericardiocentesis since the fluid had persistently recurred three months after repeated pericardiocentesis.

Open operation allows of complete emptying of the pericardial sac, which is probably always impossible by aspiration, owing to accumulation of fluid laterally behind the heart. This procedure affords an opportunity for evacuating trabeculated cavities, if such are present and for obtaining a specimen of pericardial tissue for diagnosis. Further there is the possibility that an open operation may prove curative in this condition.

eight weeks before death. Necropsy revealed a double pleurisy with effusion, ascites, and a hemorrhagic pericardial exudate. The pericardium was tuberculous but no other tuberculous lesions were found (Virchow).

CASE III.—A man aged fifty-eight years, an inmate of an insane asylum, died suddenly of heart failure after a progressive loss in weight extending over a period of several months; there were no other symptoms. Necropsy revealed a greatly thickened "Perlsuchtartige" nodular pericardium. The typical histologic findings of tuberculosis and a few *Bacillus tuberculosis* were demonstrated in these nodules, but there was no other evidence of tuberculosis (Meltzer).

CASE IV.—A woman aged sixty years had had a clinical diagnosis of pyelonephritis. Necropsy revealed areas of hyperemia on the visceral pericardium and grayish tubercles in the circular sinus and along the origin of the great vessels. Microscopic examination of these tubercles showed giant-cells and a few *Bacilli tuberculosis*. The parietal pericardium was not involved. The mediastinal glands, bronchial glands, and those at the hilus of the lung were examined grossly and microscopically in serial sections but no evidence of tuberculous involvement was found. The cervical, axillary, retroperitoneal and inguinal glands, the lungs, pleurae, and other organs were also carefully examined for tuberculous involvement, with negative results (Scagliosi).

CASE V.—A woman aged seventy-one years had had a clinical diagnosis of uremia, nephritis, myocarditis, hydrothorax, and pulmonary edema. Necropsy revealed a pericarditis with 600 c.c. turbid fluid in which large numbers of *Bacilli tuberculosis* were demonstrated by direct smear of the exudate. The diagnosis was confirmed by guinea pig inoculation. A most careful search anatomically failed to reveal any miliary tubercles, and microscopic examination showed neither giant-cells, tubercles, nor caseation. The author calls this tuberculous inflammation ("Tuberkelbacillenentzündung") and believes that the absence of characteristic tissue changes is due to a low-grade infection (Fromberg).

An alternative method of treatment that has been used with success has been the injection of air into the pericardium following aspiration of the fluid (Wenckebach, Weil and Loiseleur). This method of treatment seems to offer the possible advantage of limiting the tuberculous exudate to the pericardial cavity and is a prevention of later adhesive pericarditis. On the other hand, argument has been raised that the open operation mobilizing the chest wall by rib and cartilage resection, while not preventing adhesions, may nullify their possible harmful effect.

The complicating phlebitis of the saphenous veins early in the course of the disease is an argument against the supposition that the treatment in this case caused the later jugular and subclavian phlebitis. Richard described a case with involvement of the internal saphenous. Bérard and Péhu report a case with thrombosis of the right external jugular vein and swelling of the right arm. Manges had a case in which embolic hemiplegia developed three days after aspiration. At necropsy an area of softening was found in the lenticular nucleus. When the involvement of the myocardium, particularly the thin-walled auricles, is considered it is easy to understand how an arterial embolus could be produced, but the mechanism of a venous thrombosis is difficult to explain. It may possibly result from the presence of bacilli in the blood-stream.

The question of the site of pericardiotomy has been fully discussed in a previous paper. It might be added that because of the danger of opening the pleural cavity by an incision at the sternal edge, fifth interspace xiphosternal approach might be advisable as used in the case by Bérard and Péhu.

ABSTRACTS OF 8 CASES REPORTED IN THE LITERATURE SINCE 1897

CASE I—A man, aged eighty years, died of pericarditis with effusion. At necropsy the pericardium was found to be tuberculous, but there was no evidence of tuberculous involvement elsewhere (Virchow).

CASE II—A man aged forty-nine years had developed dyspnea, edema, and a pericardial friction following exposure

eight weeks before death. Necropsy revealed a double pleurisy with effusion, ascites, and a hemorrhagic pericardial exudate. The pericardium was tuberculous but no other tuberculous lesions were found (Virchow)

CASE III.—A man aged fifty-eight years an inmate of an insane asylum, died suddenly of heart failure after a progressive loss in weight extending over a period of several months there were no other symptoms. Necropsy revealed a greatly thickened "Perlsuchtartige," nodular pericardium. The typical histologic findings of tuberculosis and a few *Bacillus tuberculosis* were demonstrated in these nodules, but there was no other evidence of tuberculosis (Meltzer)

CASE IV.—A woman aged sixty years had had a clinical diagnosis of pyelonephritis. Necropsy revealed areas of hyperemia on the visceral pericardium and grayish tubercles in the circular sinus and along the origin of the great vessels. Microscopic examination of these tubercles showed giant-cells and a few *Bacilli tuberculosis*. The parietal pericardium was not involved. The mediastinal glands, bronchial glands, and those at the hilus of the lung were examined grossly and microscopically in serial sections, but no evidence of tuberculous involvement was found. The cervical, axillary retroperitoneal, and inguinal glands, the lungs, pleura and other organs were also carefully examined for tuberculous involvement, with negative results (Scagliosi)

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CASE VI—A man aged fifty-seven years died after an illness of five weeks with symptoms characteristic of pericarditis with effusion. One pericardiocentesis with evacuation of yellow serous exudate had been performed. Necropsy showed a thickened pericardium with nodules containing areas of necrosis and giant-cells. The author concludes from the necropsy findings that this was a case of primary tuberculous pericarditis (Marécaux).

CASE VII—A man aged sixty-six years died after one month of illness, characterized by dyspnea and pain in the chest. Necropsy revealed an obliterative type of tuberculous pericarditis with 100 c.c. hemorrhagic exudate. *Bacillus tuberculosis* was demonstrated in the pericardium after prolonged search. The lymphatic glands were not enlarged and no tissue changes characteristic of tuberculosis were revealed by microscopic examination (Nasov).

CASE VIII—Jahn reports a case of pericarditis clinically diagnosed tuberculous, which was primary in the pericardium.

Fromberg states that Simmonds observed 2 cases similar to his own.

Numerous cases of tuberculous pericarditis with involvement of the mediastinal or bronchial glands are reported (McPhedran, Hansen, Monnier and Durbin, Beréty Kast, and others) Schrötter²⁸ reported a case in which a tuberculous pericarditis with myocardial involvement was associated with an old focus in the apex of the right lung.

Riesman reported as primary tuberculous pericarditis "in the clinical sense" a case in which there was found at postmortem beside the tuberculous pericarditis an old healed tubercle in the right lung.

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DEVELOPMENTS AND POSSIBILITIES OF THORACIC SURGERY

AMBROSE L. LOCKWOOD

IN following the development of medicine and surgery from the earliest times one interested in thoracic surgery will be impressed by the fact that some of the earliest recorded surgical procedures were for wounds in the thorax. Because of the size and prominence of the chest as compared with the rest of the body and because it was recognized that a puncture wound in the chest was so rapidly fatal or so quickly incapacitated the victim for centuries in close fighting the thorax has been selected as the most vital point to attack.

In the history of wars are recorded instances of a soldier whose lung partially protruded and the protruding part was excised or more often cauterized. Empyema following such wounds was recognized. Hippocrates described empyema almost as completely as it has been described up to the present time. Hermetic sealing of wounds in the chest was practised. Alexander the Great in the battle of Malli 'blew air and blood from his chest wound' following injury by a spear but recovered when the hole was sealed over. Galen cites a case in which part of the sternum was removed, the pericardium opened, and the pus swabbed out and complete recovery followed. A high mortality from puncture wounds in the chest has been recorded throughout medical literature. The younger Larrey reports that most of the fatal wounds in Paris in 1830 were thoracic wounds. Intercostal stabs and caustic punctures for abscess of the lung have been recorded for centuries.

With the advent of general anesthesia and the use of antiseptics, and later the aseptic technic, surgery of all other parts of the body rapidly developed. Fear of pulmonary collapse and

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suffering from wounds of other parts of the body such as the abdomen, head, and joints or from compound fractures of long bones. The development of this work has been reported in the literature repeatedly. I wish only to repeat that when it was realized that the thorax could be opened and explored and the contents handled with as little risk as that attending the manipulation of the abdominal viscera, perfection of technic was all that remained to bring thoracic surgery to the standard it has attained today. The war and the epidemic of influenza gave an extraordinary opportunity for thoracic surgery and during that time it undoubtedly developed more rapidly than it had in all previous centuries. Cases I and II illustrate the development and possibility of thoracic surgery.

CASE I—Lieutenant T, aged thirty-four years, was admitted to an advanced surgical unit February 23, 1917, eight hours after a bilateral gunshot wound of the chest; the missile had lodged on the right in the liver.

The respirations were 60, short and jerky. Pain was intense on both sides of the chest, low down; the upper abdomen was rigid; a roentgenogram was not available. Examination left no doubt of laceration of the diaphragm on both sides. The patient did not respond well to resuscitation. Intense dyspnea and painful respirations were great contributing factors to the shock, and he was sinking rapidly. Operation and closure of the laceration of the diaphragm promised the only means of saving his life.

Under paravertebral anesthesia the left chest was opened first. The wound in the chest was excised and the incision extended in the interspace. A laceration 7.5 cm. long was found in the diaphragm on the left. The wound in the diaphragm was excised and sutured with catgut. A piece of shrapnel about 3 cm. long and 1.5 cm. in diameter was found embedded in the lower lobe of the lung, which was in about one-half collapse. The track and bed of the missile were excised *en masse* and the incision in the lung closed by suture. There was a large hemothorax. The pleural cavity was swabbed dry and the incision in the chest wall closed without drainage. The patient was placed in a semisitting posture, inclined somewhat to the right.

death undoubtedly accounted for the temerity of the surgeons in dealing with thoracic conditions. All efforts were directed toward the development of either a negative or a positive pressure apparatus which would insure the maintenance of lung expansion. Sauerbruch and his followers, on the Continent, and Willie Meyer in this country devoted years to perfecting a negative pressure chamber. Although Sir William MacEwen almost twenty years ago pointed out that the lungs did not always collapse when the thorax was opened, and reported personal experiences in thoracic cases that should have greatly stimulated thoracic surgery surgeons confined their thoracic work to conditions which were considered inevitably fatal unless some surgical measures were instituted.

It was a great pity far beyond the imagination of all but a few that surgery of the chest had not advanced as had surgery of other parts of the body at the outbreak of the Great War. Between August, 1914 and the late summer of 1916 thousands of young men died unnecessarily of gunshot wounds in the chest. Before the spring of 1916 in most surgical units in France the routine treatment, almost as carried on to the end of the war had been established for gunshot wounds of the head, abdomen, joints, fractures, and, in fact, practically all parts of the body. There still remained a type of wound which all surgeons learned to dread one which killed quickly or left the victim to die slowly of sepsis. For many months I watched men brought in with gunshot wounds of the chest my unit had more than 80 beds for patients with chest wounds 62,000 seriously wounded passed through the unit in five months 19,000 in one month. One cannot readily forget the dread in making the daily rounds of the patients wounded in the thorax, consigning a certain percentage of them to morphinization and an easy death because we had not learned to help them surgically. In my unit not until July 1916, and even late in the fall of that year did we realize that approximately 73 per cent. of patients suffering from what we considered to be 'necessarily fatal' wounds of the chest could be saved and restored to health, and in most cases to more complete usefulness and with less permanent disability than men

Following active resuscitation—heater-bed omnopon, intravenous injection of 600 c.c. of a 2 per cent. sodium bicarbonate solution, and glucose and sodium bicarbonate by rectum—he rallied slowly and a blood transfusion of 600 c.c. was given.

Six hours after admission the patient was taken to the operating room the pulse was 130 to 140 the systolic blood pressure 85 respirations were rapid the right chest was not moving. It was thought that the patient was still bleeding. The entire abdomen was rigid. Just to the right of the body of the third lumbar vertebra was a large entrance wound admitting three fingers, and over the costal cartilage of the ninth rib in the anterior axillary line was a dirty jagged exit wound admitting three fingers. The colon was herniated through the exit wound and presented a gangrenous patch almost 2 cm. in diameter and with an area of laceration 1.25 cm. in diameter. Paravertebral and local anesthesia were administered. The incision was made from the edge of the third lumbar vertebra to the cartilage of the ninth rib. The entry and exit wounds and the torn deep muscles of the back were excised *en masse*. The gangrenous patch in the large bowel was excised and the opening closed with Caerny Lambert sutures of linen thread. The colon was replaced in the peritoneal cavity. There was a wide open laceration of the diaphragm 12 cm. long about 1 cm. from the parietal attachment. The lung was almost completely collapsed. The blood clot was removed with a hand. The pleural cavity was swabbed dry. The diaphragm was sutured with chromic catgut. A laceration of the outer and lower border of the liver admitted three fingers but the liver was not bleeding. The peritoneal cavity was swabbed dry and the peritoneum closed. The right kidney was found to be split beyond repair. The incision was closed except for a two-way catheter left in the pararenal space for forty-eight hours. The operation was carried out entirely under local anesthesia without any gas or oxygen. 500 c.c. of sodium bicarbonate was given intravenously at the end of the operation. Recovery was complete and uneventful. The lung was in almost complete expansion in less than forty-eight hours.

side, deep breathing was encouraged, glucose and sodium bicarbonate were given by rectum and oxygen was administered through a mask. The patient was left on the operating table in this position for an hour and one-half. At the end of that time he improved remarkably but he still complained of severe pain in the right side. The left lung expanded fairly well. After a paravertebral injection the wound in the right chest was excised the right lung was in two-thirds collapse a patent jagged opening in the diaphragm readily admitting two fingers was found. The wound in the diaphragm was excised and the incision extended so as freely to expose the upper surface of the liver. A track admitting one finger led to the missile at a depth of 5 cm. in the substance of the liver. The missile was removed the track and bed of the missile thoroughly curetted and swabbed out with saline solution then with ether and the liver sutured with catgut. The wound in the diaphragm was closed with a single layer of fine chromic catgut sutures. There was hemothorax of about 500 c.c. the pleural cavity was swabbed dry and the incision in the chest wall closed. The patient was returned to a partial sitting posture in bed, oxygen was administered, glucose was given by rectum and sodium bicarbonate intravenously. The peculiar pain in the diaphragm was relieved at once by operation, and in eighteen hours the left lung was practically in total expansion the right lung in about two-thirds expansion. The patient had an absolutely uninterrupted and easy recovery.

The type of wound in this case usually was fatal within from a few minutes to a few hours, so that the wounded man never reached a base unit, but usually died on the field of battle in the advance dressing station, or in the casualty clearing station. By operation within from fifteen to eighteen hours after being wounded 60 per cent of the patients with such wounds were saved and ultimate recovery following successful operation was complete and without any permanent disability.

CASE II.—Gunner C. aged thirty-one years was moribund on admission September 27 1917 with penetrating chest wound extensive hemothorax laceration of the diaphragm liver and kidney and hernia of the colon.

expectorated about 600 c.c. of foul-smelling reddish-brown sputum a day. Forced feeding was instituted and he was given a glass of 5 per cent. glucose solution to be taken over a period of two or three hours and 120 gm. of sodium bicarbonate in twenty-four hours. Hemorrhage of about 500 c.c. occurred on the third day after admission and on three other occasions in variable amounts within the next ten days. After the second hemorrhage an attempt was made to collapse the lung with oxygen, but the patient was so acutely ill that he could not be



Fig. 619

Fig. 620

Fig. 619—(Case A360,675.) Roentgenogram on admission, June 7, 1921.

Fig. 620—(Case A360,675.) Roentgenogram on discharge, August 1, 1921.

moved in order to have a roentgenogram made for the determination of the extent of collapse. His condition was so serious that transfusion was considered. His coagulation time of nine and one-half minutes was reduced to three and one-fourth minutes by the administration of calcium chlorid (10 c.c. of a 10 per cent. solution intravenously) on three occasions at intervals of from five to six days. The patient continued to spit up dark blood-stained sputum for four weeks. However, he did not have any further active hemorrhage and gradually improved in health.

Empyema Acute and Chronic.—With repeated aspirations during the acute period, the use, if advisable, of the trocar and cannula, and, when necessary intercostal thoracotomy the death-rate from acute empyema is almost nil. If acute empyema is properly handled chronic empyema is extremely rare and the proper treatment of the chronic type reduces the total death-rate to approximately 2 per cent. Mutilating operations such as the Schede and Estlander should be unnecessary and re-expansion and complete function of the affected lung should be obtained.

Lung Abscess.—A much smaller percentage of cases of lung abscess are now considered surgical than formerly but the operation when undertaken is more radical, more rational, and more likely to result in complete cure. The condition of the majority of patients suffering from lung abscess will clear up entirely if the patients are put to bed at once in the open air with postural drainage and given alkalis to offset acidosis, glucose to maintain the glycogenic function, and forced feeding to maintain strength. An operation should be undertaken only after this treatment has been given a thorough trial. When operation is undertaken it should be as palliative as possible and yet sufficiently extensive to allow evacuation, proper drainage and obliteration of the cavity. Lately the mortality in these cases has been greatly reduced and the ultimate result improved. Cases III and IV illustrate the nature of the disease and the result of treatment employed in these cases.

CASE III (A360 675)—M. H. aged twenty-eight years, who registered in the Clinic June 1921 had been ill for eleven weeks, during which time he had lost 40 pounds in weight. He had had hemorrhages for about two weeks and was pale and emaciated.

Examination revealed an enormous abscess of the lung involving the upper right lobe (Fig. 619). The temperature was 103° F. The leukocytes numbered 15,400. The pulse-rate varied from 112 to 120. There were signs of a large cavity in the upper lobe of the right lung with consolidation below.

The patient was put to bed in the open air, he was inclined to the right side with ice bags over the entire upper chest. He

expectorated about 600 c.c. of foul-smelling reddish-brown sputum a day. Forced feeding was instituted and he was given a glass of 5 per cent. glucose solution to be taken over a period of two or three hours, and 120 gm. of sodium bicarbonate in twenty four hours. Hemorrhage of about 500 c.c. occurred on the third day after admission and on three other occasions in variable amounts within the next ten days. After the second hemorrhage an attempt was made to collapse the lung with oxygen, but the patient was so acutely ill that he could not be



Fig. 619

Fig. 620

Fig. 619—(Case A360,675) Roentgenogram on admission, June 7, 1921.

Fig. 620—(Case A360,675) Roentgenogram on discharge, August 1, 1921.

moved in order to have a roentgenogram made for the determination of the extent of collapse. His condition was so serious that transfusion was considered. His coagulation time of nine and one-half minutes was reduced to three and one fourth minutes by the administration of calcium chloride (10 c.c. of a 10 per cent. solution intravenously) on three occasions at intervals of from five to six days. The patient continued to spit up dark blood-stained sputum for four weeks. However, he did not have any further active hemorrhage and gradually improved in health.

and was up and about by the middle of July. August 1st he was dismissed from our care entirely well (Fig. 620).

Three years earlier I would have considered this type of case urgently surgical. However a patient with such an extensive abscess and so acutely ill belongs to the group in which the mortality rate following operation is high. Other cases similar to this have convinced me that well-controlled medical treatment should be tried out before an operation is undertaken. An interesting feature of this case is the development of a large pyogenic abscess without any demonstrable etiology.



Fig. 621 —(Case A335,392.) Roentgenogram on admission, October 1, 1920.

CASE IV (A335,392) — Mr. L., aged thirty-six years, registered at the Clinic September 27, 1920, because of the condition of his chest, which elsewhere had been diagnosed lymphosarcoma. Three months before coming to the Clinic he had had an operation in the eighth interspace for what had been considered an encapsulated empyema that had developed following pneumonia secondary to pleurisy; however, no pus was found.

Examination revealed that the patient had lost 50 pounds in six months, and was expectorating a foul-smelling sputum

He had clubbing of the fingers and watch-crystal nails. He complained of pain in the right chest. His hemoglobin was 76 per cent. the leukocyte count was 6400. Repeated examinations of the sputum gave negative results. The first roentgenogram revealed a shadow in the right upper mediastinum, probably of sarcoma (Fig 621). The fact that since following the operation

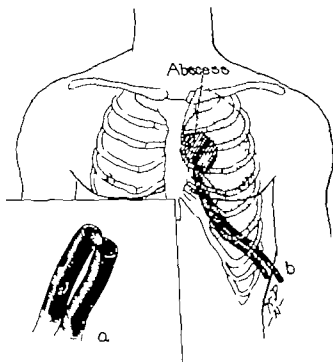


Fig 622 —a, Two-way drain inserted dependent from the abscess cavity (b) in Case A335,392.

elsewhere the patient had begun to produce a good deal of sputum and had improved somewhat generally suggested either an encapsulated empyema or a lung abscess. The sharp outline of the shadow however the enormous loss of weight, the low leukocyte count, and the general aspect of the patient suggested sarcoma.

October 6 1920 an operation was performed under paravertebral anesthesia. The old sinus from the previous operation was excised and found to lead up to a small pocket close to the mediastinum, to which the lung was adherent. The lung, which was adherent to the mediastinum throughout, was separated from its attachment so that a mass in the lung could be palpated. This mass at first felt like a solid tumor but a small area of softening with fluctuation was found and with my finger



Fig. 623.

Fig. 624.

Fig. 623.—(Case A333,392.) Roentgenogram made two weeks after operation (Fig. 622).

Fig. 624.—(Case A333,392.) Roentgenogram on discharge, December 4 1921.

I managed to open into an abscess. Considerable pus escaped. A two-way catheter drain was left leading from the abscess (Fig. 622). The incision was partially closed. Much foul-smelling pus escaped through the catheter but gradually diminished in amount. Two or three times a day a little saline solution was passed through the long end of the catheter merely to clear it. The patient was up and about a few days after the operation. November 19th he was discharged from the hospital and two

weeks later he was discharged from the Clinic entirely cured (Figs. 623-625)

This case illustrates the difficulty of an accurate diagnosis in such conditions and the value of an operation that is palliative and yet sufficiently extensive to secure adequate drainage. Had

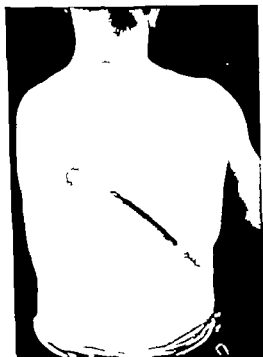


Fig. 625.—(Case 335,392.) The healed incision. The first incision, made elsewhere, was made too low to allow easy access to the abscess area. The scar was excised and the incision enlarged.

the condition not cleared up I would have opened the chest in the fifth interspace delivered the lung partially through the chest wall, fixed it there and excised the lung tissue over the abscess wide enough thoroughly to expose the abscess, leaving it as a saucer-shaped cavity. The cavity would have been thoroughly packed with gauze wrung out of 5 per cent. sodium

chond in glycerin, and an attempt made as early as possible to close it over with a pedicle skin-graft.

Bronchiectasia.—Patients with bronchiectasia seldom come for consultation early enough for surgery and only after thorough medical treatment along the lines advocated for lung abscess should surgery be instituted. Partial pneumectomy is advisable in a few cases of unilateral bronchiectasis and artificial pneumothorax or manual collapse in a certain percentage. In bilateral bronchiectasis collapse of the more severely affected lung is the limit of judicious surgery. The best result is partial rather than complete cure.

Foreign bodies, whether in the pleura, lung, mediastinum, pericardium, or heart, can easily be removed. The localized sclerosids that surrounds most foreign bodies in the lung tissue often extends to become a diffuse sclerosids, very often involving an entire lobe. An area of focal infection may persist around the foreign body. Apart from the pathologic condition the majority of patients continue to worry about the presence of the foreign body. Although all patients may not have recurrent attacks of fever and the tendency to colds, chills, and so forth, I am convinced that the majority should be operated on.

Traumatic Lesions.—In the so-called *love-in chest*, whether or not there is traumatopnea, where there is marked respiratory distress, severe pain complicated with hemothorax, evidence of rough jagged portions of ribs protruding through the parietal pleura and lacerating or irritating the visceral pleura with each inspiration, surgical interference is advisable. Death from the shock and exhaustion from the gross bony lesion can be avoided by removal of comminuted bone and sharp specula, and the long-drawn-out subsequent distress, even if the patient does not succumb to shock, is avoided. Laceration of the diaphragm may cause sufficient distress to be diagnosed and should be repaired through the thoracic route unless there is complicating abdominal condition which could not be dealt with at the same time through this incision.

Tumors of the Thoracic Wall.—Tumors of the thoracic wall are now being operated on more often than formerly and more

successfully. Resection of the underlying attached lung or pericardium is possible.

Thymus.—At least partial thymectomy is possible and may yet prove to be advisable in patients with exophthalmic goiter who have large persisting thymuses. In some patients suffering from exophthalmic goiter who die following ligation or thyroidectomy no cause of death is revealed by necropsy but large thymuses are found. It is possible that partial resection of the thymus should be performed at the same time of or preceding thyroidectomy.

Purulent Pericarditis.—In cases of purulent pericarditis unless the pus can be aspirated readily the patient thereby improved, it is wiser to open wide the pericardium through a left parasternal incision of the fourth, fifth, or sixth costal cartilages. The cavity should be swabbed out thoroughly with saline solution and then with ether and closed without drainage. It is impossible to aspirate the pus over the transverse sinus except by the dangerous procedure of posterior aspiration. Pus tends to accumulate in the pouch behind the heart, and no matter in what position the patient is placed for aspiration, the pouch over the sinus will retain pus.

Subdiaphragmatic abscess and high or deeply placed hepatic abscesses can best be emptied through an abdominal thoracic incision if the diaphragm is opened wide (Fig. 626).

Hernia of the diaphragm can be dealt with most directly and most satisfactorily through the thoracic route.

Spleen.—I am not sure that splenectomy cannot be performed more easily through a combined low intercosto-abdominal incision than through the abdominal route.

Carcinoma of the Cardia.—Possibly a higher percentage of carcinomas of the cardia, which at present are considered inoperable because of their high position, may be dealt with through a combined abdominothoracic incision.

Carcinoma of the Esophagus.—A certain percentage of the cases of carcinoma of the esophagus diagnosed early will yet come to operation through a thoracic approach. I believe that although resection and suture of the esophagus does not seem

feasible except for a very limited annular growth, reconstruction by tube skin-graft, as Lillenthal recently demonstrated, is possible.

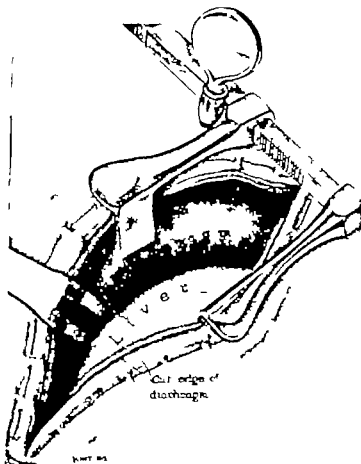


Fig. 626.—Retraction of the diaphragm, showing space between and the liver.

Intrathoracic Malignancy—Early diagnosis is all that is necessary for the assurance of some extension of life by operation

in the cases of primary malignancy of the pleura and lung that occur often enough so that in the course of a year many come under observation in the Clinic. Lymphosarcoma elsewhere in the body responds so well to radium that it should easily be possible greatly to benefit and extend life in lymphosarcoma of the thorax or its contents. Beck recently reported and demonstrated a most interesting case of a young woman with sarcoma of the lung who had apparently been cured by direct application of radium after the chest wall over the mass had been removed. It is a simple matter to expose a mass anywhere within the thorax, and extirpation is easily possible unless the tumor surrounds the main vessels or the large bronchus at the hilus. I have opened many chests in which there were malignant growths but in only 7 the chest wall, mediastinum, diaphragm or pericardium were not involved by extension. I am now of the opinion that if a limited resection of the chest wall will clear the growth it should be performed if necessary in two or three stages. If on opening the thorax the deep supraclavicular glands show metastasis or there is fluid in the thorax and certainly if the mediastinal glands show metastasis further surgery except for relief of symptoms is contraindicated. Except in one case I have never done more than explore or remove specimens for diagnosis in the cases of so-called primary malignancy of the lung. Recently I have explored several patients in whom complete extirpation of the mass would have been possible had they come under observation a few weeks or months earlier before metastasis and extension had occurred. I am recounting one of the patient's histories in Case V.

CASE V (4360 988).—Mr. H. aged fifty-one years, came to the Clinic with his wife June 10, 1921. The physician who examined his wife noticed that he spat a reddish sputum and advised him to be examined. He registered and the only complaint he gave was that he had had blood-stained sputum for four weeks.

Physical examination of the chest did not reveal any abnormality but in the roentgenogram was a vague shadow over the anterior surface of the left lung. On the basis of the roentgenogram and the blood-stained sputum a diagnosis of early

feasible except for a very limited annular growth reconstruction by tube skin-graft, as Lillenthal recently demonstrated, is possible.

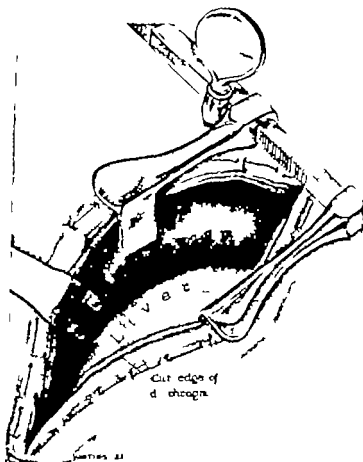


Fig. 626.—Retraction of the diaphragm, showing space between it and the liver.

Intrathoracic Malignancy—Early diagnosis is all that is necessary for the assurance of some extension of life by operation.

second day the patient was out of bed, the third day up and about the room, and after the fourth day up and out of doors. The tenth day he left the hospital and went home none the worse for the operation. The pathologist's diagnosis of the specimen removed was carcinoma.

If in this case of carcinoma which was found entirely by accident, operation had been undertaken earlier before the

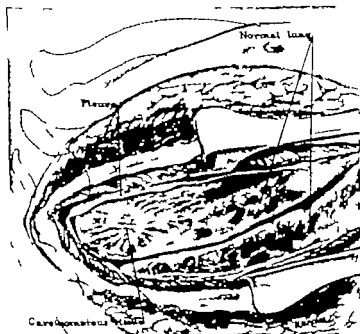


Fig. 628—Exposure of tumor in Case A360,988.

growth had extended so diffusely through the lung and before necrosis had set in, resection of the entire cancer bearing portion of the lung probably would have been possible. I am not sure that the x-ray treatment in this case was not harmful. The patient was opposed to radium treatment following operation. Until the effects of intensive x-ray treatment in such cases is more definitely determined I should hesitate to advise such

primary carcinoma of the lung was made. The hemoglobin was 70 per cent., the leukocyte count 5200 \times Ray treatment was recommended and examination of the patient every two weeks. After seven weeks the shadow on the roentgenogram had extended and the patient was losing strength. An exploratory thoracotomy was advised.

August 3 1921 intercostal thoracotomy was performed in the fifth interspace under paravertebral anesthesia. The incision extended from the costal cartilage along the fifth interspace to the posterillary line (Fig 627) The lung was not adherent to the parietal pleura. About 240 c.c. of yellowish-red serous fluid was found free in the pleural cavity. Although the chest was

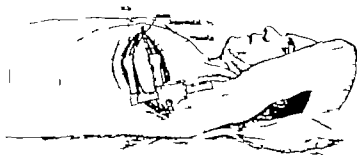


Fig 627 —Incision for thoracotomy in Case A360,953 retractor in place

opened wide the lung remained in complete expansion. The entire anterior medial portions of the upper lobe showed scarring and small nodular fibrosed areas here and there with softening and degeneration. A large irregular mass already necrosed could be palpated in the lower and medial portion of the upper lobe. The visceral pleura was not adherent to the parietal pleura at any point (Fig 628) None of the glands in the mediastinum was palpable. A specimen of the lung was removed for diagnosis. Because of the extensive involvement of the lung and the fact that necrosis was present further surgery was not indicated. The thorax was closed without drainage and aspirated at the end of eighteen, thirty and forty hours, to the fourth day. The

but the peculiar distress from pressure was relieved. Although the life of these patients was not materially lengthened, they were made much more comfortable and did not die so painful a death.

With the increasing use of the x ray throughout the country conditions within the chest, heretofore recognized too late should be discovered and brought to operation while relief is still possible. I hope that I shall live to see the day when people will go to the physician every year or year and a half just as they go to the dentist, and that no examination will be complete without a thorough roentgenographic examination. When that time arrives operation for intrathoracic tumor will not be uncommon.

DIAGNOSIS OF THORACIC CONDITIONS

The value of a roentgenographic examination in thoracic conditions cannot be overestimated. Full-sized stereoscopic plates showing both sides of the chest and the diaphragm should be made. Movements of the thoracic contents and diaphragm can be determined only with a screen. The roentgenograms show the approximate amount of fluid and the presence of pneumothorax, the degree of collapse of the lungs, the position of the heart and mediastinum, the level of the diaphragm, the extent of bronchiectasis, the cavitation of the lungs, the presence of active or quiescent tuberculosis, metastasis, hematoma of the lung, the presence of foreign bodies, and the position and contour of a mass. Repeated roentgenographic examination is necessary during the progress of the case.

CHOICE OF ANESTHESIA

If for any reason one lung is partially or completely incapacitated, anything which may endanger the air bearing capacity of the other should be avoided. While bronchopneumonia is not a common sequel of general anesthesia, the stormy convalescence or the mortality rate to the particular person who contracts bronchopneumonia is 100 per cent. The postoperative retching, vomiting and restlessness which frequently follow general anesthesia are better avoided in a patient who has had

treatment previous to operation. I should prefer to open the chest and if possible, remove the growth if necessary x-ray or radium treatment may be instituted later

The extirpation should be attended by a prognosis for extension of life as good as radical excision of such a mass elsewhere in the body. I have removed a dermoid cyst of the lung and a cyst of the diaphragm which had been diagnosed cancer elsewhere. The patient with the cyst of the diaphragm had been advised that the mass was cancerous and inevitably fatal, and for five months had been living in dread of impending death. The mental relief in this case can be appreciated. In each of the 7 cases mentioned a carcinoma was confined to the lung itself but it was so extensive and already degenerating and the patients so wasted and debilitated that only complete pneumectomy could be considered. Exploratory thoracotomy through an intercostal space is attended by an even lower mortality rate than exploration of the abdomen for undetermined carcinoma. Unless there is already evidence of metastasis, the thorax should be explored. Even in a certain percentage of cases, in which excision of the mass seems certain not to be feasible palliative operation is indicated. In a certain number of cases a growth in the lung or pleura had extended to the diaphragm or pericardium in the former case causing a deep constant pain with frequent vomiting and in the latter a deep precordial pain, and at times a peculiar unpleasant sense of pressure on the heart. In the treatment of such cases I have opened the thorax wide in an interspace and stripped the mass off the diaphragm or pericardium as the case may be if it was possible I turned the healthy lung over the raw exposed area and sutured it there or manually collapsed the adjacent portion of lung so that it no longer came in contact with the raw area of the diaphragm or pericardium. All patients operated on in this manner experienced remarkable relief. One patient who had been vomiting for nine weeks did not vomit again. Patients with pain in the diaphragm have always been relieved, but in one or two with pain in the pericardium the pericardium was directly adherent to the parietal pleura and this continued to cause some pain

about the large veins of the hilus the patient undoubtedly died from massive air embolus. The second death was in a case of perforating gunshot wound of the aorta which I have previously reported and death was due to extensive hemorrhage from the aorta itself. With patients under general anesthesia even nitrous oxid and oxygen I have been forced to hurry the closure not because of the dyspnea alone, but because one lung was more or less collapsed and the patient was not readily re-oxygenating the blood through the one functioning lung. I have never observed this condition with paravertebral anesthesia alone which leads me to doubt whether any altered position of the

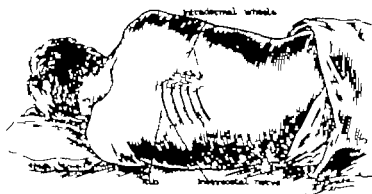


Fig. 629—Points of paravertebral injection for thoracotomy

heart or pressure on the opposite lung could be causative in producing the distress.

The paravertebral anesthesia which I have employed for seven years is a simple infiltration of the nerves as they come out of the intervertebral foramina in front of the transverse process of the vertebra (Fig. 629). The needle should go deep enough to catch the sympathetic fibers as well thereby rendering painless the manipulation of the intrathoracic contents. It is necessary to inject two or three spaces above and below the one to be incised. The injection of one side is, of course sufficient unless extensive exploration of the mediastinum is contemplated.

an extensive thoracic operation. If there were a simpler method of inducing anesthesia either of positive or negative pressure and thereby maintaining the lungs in expansion without ill effects from the anesthesia itself I am sure that most surgeons would adopt it. Our nearest approach to the ideal is gas and oxygen but so often it is necessary to add ether to secure sufficient narcosis. I have had no personal experience with the negative pressure apparatus, but I have given the positive pressure apparatus a good trial. Until some simpler means of maintaining anesthesia is found, I would urge that paravertebral anesthesia and, if necessary some gas and oxygen during the manipulation within the chest, should be employed. Operation can be performed in the most serious cases with this type of anesthesia. An extensive, deliberate, and protracted operation can be carried on with the minimum risk to the patient. Respirations are deeper and more regular than with the general anesthesia and, to some extent, the movements of the lungs, mediastinum, and diaphragm can be controlled voluntarily by the patient, thus greatly aiding the operator. Ether and chloroform are contraindicated in surgery of the chest unless the lung on the side to be operated on is in expansion and adherent to the chest wall. The deductions of Graham and Bell from experiments on animals as to the size of the thoracic opening that is safe has no practical application to man. In operating on some hundreds of chests I have never had a case in which I believed that the large size of the incision was in any way responsible for the dyspnea that occasionally occurred. On the contrary there is no doubt that a small opening in the thorax more often causes respiratory distress than a large one. I have never seen any alarming sequel following a wide incision in the chest wall. Whether or not the lung will collapse when the thorax is opened cannot be predicted. On the contrary very often the lung seems to expand almost as if to force its way through the incision. Complete collapse is extremely rare one-half collapse is usually the limit. In nearly 3000 patients operated on for lesions in the chest only 2 deaths have occurred on the table. One death was in a case of carcinoma of thyroid tissue implanted in the lung with an area of calcification

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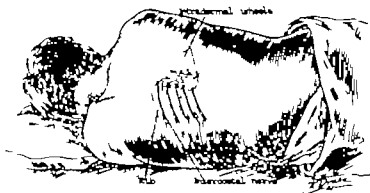


Fig. 629.—Points of paravertebral infection for thoracotomy

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Local infiltration well back from the line of incision is frequently combined with the paravertebral injection in order to overcome the delay of from fifteen to twenty minutes that is necessary for a purely paravertebral anesthesia to be completely effective. One per cent. novocain made up in normal saline solution and 0.25 per cent. potassium sulfate to which 10 minims of adrenalin to each 30 c.c. is added just before use is employed. One-half per cent. novocain is employed for local infiltration. $\frac{1}{16}$ grain scopolamin and $\frac{1}{4}$ grain morphin or one ampule of omnopon and scopolamin (Roche) are given one hour before operation. Gas and oxygen should be at hand should the patient become restless or the manipulation with the thorax excite a troublesome cough.

OPERATION

In operation for a thoracic lesion apart from empyema or lung abscess the absolute essential is rigid asepsis. Although



Fig. 630.—Incision with points of infiltration for operations on the chest

the risk from infection is not so great as in operating on the abdomen and although the pleura undoubtedly is more resistant to infection than the peritoneum, empyema following a simple thoracic operation is a grave sequel. A separate operating theater should be maintained for clean thoracic cases.

The patient should be placed on the table with the side to be operated on dependent. A partial sitting posture is a good position. In most cases an intercostal incision of the fourth or fifth space extending from the postaxillary line to the middle clavicular line provides the easiest access to the thoracic cavity



Fig. 631—A convergent lighted retractor

(Fig. 630) Of course the incision must be so placed as to allow thorough examination of the part involved. Also it must be in such a position that easy access to the hilum of the lung and control of the large vessels is possible. Resection of ribs is rarely necessary. Occasionally it is wise to extend the incision

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mediastinum are necessary. The mediastinum and pericardium can be freely opened and explored lung tissue can be incised without fear of hemorrhage and resection of almost any amount of lung tissue is feasible. Care must be taken thoroughly to crush large bronchi and by suture to appose visceral pleura to visceral pleura. The diaphragm can be incised to any extent on being sutured it heals like scalp. The thoracic incision should be hermetically sealed with the first layer of muscle sutures otherwise pocketing occurs, serum accumulates and the incision breaks down. Drainage of the chest should be avoided. It is curious just why fluid accumulates even after ordinary exploration. Aspirations at the end of eighteen hours, forty hours, and sixty hours are usually sufficient. Effort is not necessary to produce expansion of the lungs should they collapse, except just before tying the final sutures the patient should cough or hold his nose and blow or a mask should be placed over his face, slight pressure exerted on the pomum adami to prevent air being forced into the stomach, and the lungs inflated with oxygen or an ordinary nasal catheter may be passed, and the lungs inflated with a bulb. As a rule no attention need be paid to the lung. I have never known a lung that collapsed at operation to remain in collapse if the chest had been hermetically sealed. At the end of the procedure the patient should at once be supported in a semirecumbent position inclined to the side operated on. He should be kept at rest in bed in the position he finds most comfortable usually half-sitting. Oxygen is administered the first twenty four hours if he is cyanosed. Morphine is freely administered to combat restlessness. Stimulants of all kinds are avoided although, if the patient is an habitual drinker brandy may be given. Routine aspiration is carried out. Physical signs are misleading and only by repeated roentgenographic examinations and aspiration can the chest be kept free of fluid. Unless there was a febrile condition prior to operation the patient should be out of bed early. He can usually sit up the second day by the third day he can get up and move around the room, and by the fourth or fifth day he should be walking about.

forward to the costal cartilages, and then through the costal cartilages above and below so as to give direct approach to the mediastinum or the hilum of the lung. By opening the thorax in the interspace unnecessary mutilation of the chest wall is avoided. Osteomyelitis and perostitis cannot result and the intercostal nerves and blood-vessels are not severed. A necro-

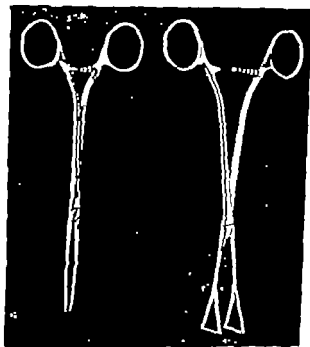


Fig. 632.—Large and small size of Deval lung forceps.

nary precaution in intercostal thoracotomy is separating the parietal pleura from the rib above and the rib below the interspace and for from 3 to 5 cm. beyond each end of the incision planned in the pleura. This facilitates closure. A powerful retractor is required. A lighted retractor (Fig. 631) to inspect the cavity and suitable forceps (Fig. 632) for grasping the lung or

RETROPERITONEAL LIPOMAS REPORT OF 12 CASES

JAMES C. MASSEY AND EDWARD J. HORGAN

RETROPERITONEAL lipomas are so often unrecognized as such before operation or necropsy that we wish to present a group of 12 cases in which operation was performed in this Clinic, with the hope that they may aid the clinician and consulting surgeon to recognize this particular variety of retroperitoneal tumor.

Most of our cases of retroperitoneal lipoma and most of the cases reported in the literature were not diagnosed correctly before exploratory laparotomy was performed, but the surgeon felt justified in making the exploration in an endeavor to relieve the patient by removing the tumor if possible. Exploration revealed a retroperitoneal tumor but in some cases reported the true pathology of the tumor was unrecognized by the surgeon, who believed it to be a neoplasm in the retroperitoneum, and consequently inoperable. In some of the cases, contrary to the expectation of the surgeon, the pathologic process did not progress rapidly or a benign lipoma was removed later at operation or necropsy. In most instances in which a retroperitoneal lipoma was recognized by the surgeon the tumor was removed. The tumor was removed in all cases in which operation was performed in this Clinic.

CLINICAL DATA

The average age of the 12 patients in our series was fifty five years the youngest was forty and the oldest seventy-two. Five were males and 7 were females. The average duration of symptoms was three years the shortest duration was one month, and the longest ten years. In six instances the presence of the tumor had been noticed by the patient and a history

As I have previously pointed out, in no other class of surgery is team work so essential to success. The surgeon, the physician, roentgenologist, and anesthetist should work hand in hand. The assistants and operating nurses should be quick and methodical, knowing each step in the operation and avoiding delay by having everything prepared in advance and at hand. Nurses who have had long experience in caring for patients postoperatively are the most important members of the team.

RETROPERITONEAL LIPOMAS REPORT OF 12 CASES

JAMES C. MASON AND EDMUND J. HORGAN

RETROPERITONEAL lipomas are so often unrecognized as such before operation or necropsy that we wish to present a group of 12 cases in which operation was performed in this Clinic, with the hope that they may aid the clinician and consulting surgeon to recognize this particular variety of retroperitoneal tumor.

Most of our cases of retroperitoneal lipoma and most of the cases reported in the literature were not diagnosed correctly before exploratory laparotomy was performed but the surgeon felt justified in making the exploration in an endeavor to relieve the patient by removing the tumor if possible. Exploration revealed a retroperitoneal tumor but in some cases reported the true pathology of the tumor was unrecognized by the surgeon, who believed it to be a neoplasm in the retroperitoneum, and consequently inoperable. In some of the cases, contrary to the expectation of the surgeon, the pathologic process did not progress rapidly or a benign lipoma was removed later at operation or necropsy. In most instances in which a retroperitoneal lipoma was recognized by the surgeon the tumor was removed. The tumor was removed in all cases in which operation was performed in this Clinic.

CLINICAL DATA

The average age of the 12 patients in our series was fifty five years; the youngest was forty and the oldest seventy two. Five were males and 7 were females. The average duration of symptoms was three years; the shortest duration was one month, and the longest ten years. In six instances the presence of the tumor had been noticed by the patient and a history

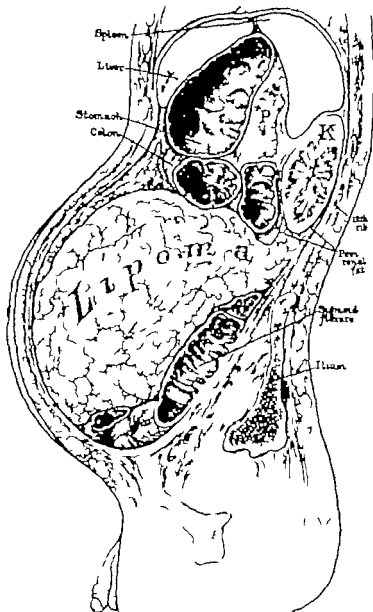


Fig. 633.—Section through the body left of the median line to show the relations of the Spleen to the abdominal organs in Case A228,249

was given of a gradual enlargement of the tumor. In one case the growth had progressed slowly for seven years. In 6 cases the tumor had not been noticed by the patient. In 3 of these the

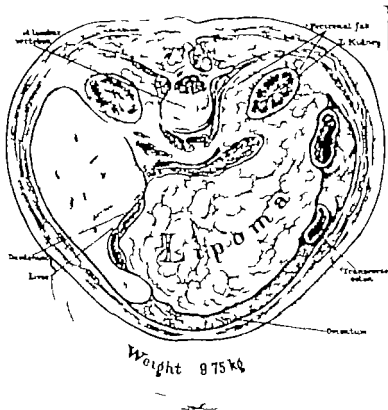


Fig. 634.—Transverse section through the body at the level of the first lumbar vertebra in Case A225,219.

tumor had been discovered by a physician and the patient informed of its presence.

Six patients complained of pain in the abdomen, and 2 of pain in the abdomen and back. Pain was severe in only one patient in whom the lipoma was found to be degenerating. Six

patients complained of food distress, with bloating and fulness. Two vomited one patient had vomited blood occasionally for five years and at these times had passed tarry stools. Five patients complained of constipation, and one patient of diarrhea. Three patients had abdominal ascites. None had symptoms of intestinal obstruction. In a few patients with the increase in the size of the tumor the hepatic mass caused a dragging sensation and inconvenience in stooping. Six patients had lost weight the greatest loss was 50 pounds over a period of two years. The weight of the patient who had the largest tumor 9.5 kg (Figs. 633-634) had remained stationary. Only 3 patients lost in strength. Three patients had frequency of urination. The only noteworthy pathologic findings in the urine were albumin in 6 cases, red blood-cells in 3 pus in 7 and hyaline casts in 1 but these changes were probably not due to the tumor.

Degenerating Lipomas (4 Cases)—These cases presented rather acute symptoms: a rise in the temperature leukocytosis, weakness, sweating, loss of appetite nausea and vomiting and pain and tenderness with induration in the tumor and adjacent tissues. One patient (Case A291,541) was under observation for two weeks before operation while the tumor was undergoing degeneration and necrosis.

CASE A291,541—Dr. C. O. S. aged forty-eight years, was examined October 1, 1919. About one month before the patient had noticed a firm, smooth, freely movable ovoid mass, about 8 cm. in diameter in the left hypochondrium. The mass had increased considerably for three weeks and could be palpated in the lower left quadrant of the abdomen. The temperature had increased during the last week from 99° to 102° F. There was dull aching pain in the back and an uneasy sensation in the lower abdomen.

Examination revealed a large solid freely movable tender mass in the left side of the abdomen, extending upward under the lower border of the ribs. The kidney could not be palpated. The percussion note was tympanitic because the tumor was covered by the colon. The leukocyte count was 7800. The Roentgen-ray study of the gastro-intestinal tract showed an

extrinsic mass, and spasticity of the transverse colon over the tumor. Urologic examination proved the tumor to be extrarenal. A clinical diagnosis was made of "perinephric abscess (?) degenerating lipoma (?) "

October 8th the leukocyte count was 28,000

October 13 1919 operation was performed. The retroperitoneal tumor was found to be in two parts they were removed separately. The larger mass was 25 by 15 by 8 cm. the smaller 14 by 10 by 8 cm. The pathologist found an area of necrosis in the center of the smaller mass, and several such areas in the larger. He made a diagnosis of myxofibrolipoma with a few fairly cellular areas.

DIAGNOSIS

In a study of these cases it was noted that relatively few symptoms accompanied these large abdominal tumors and in most of the cases they were not sufficient to oblige the patient to give up work. Patients with lipomas undergoing degeneration and necrosis had the most marked symptoms.

The diagnosis of retroperitoneal lipoma is based chiefly on the presence of a palpable ovoid movable mass with a multi globular surface which is fixed posteriorly. The patient may or may not be aware of the growth. The tumor is fairly firm, but on pressure it gives the sensation of a doughy mass. The consistency may vary in different regions in some being soft and in others rather firm. One or more masses may be present.

The position of the tumor in the abdomen varies with its attachment and size. It principally is on the side from which it originates, and therefore the bulging is on this side until the tumor becomes very large and the bulging of the anterior abdominal wall from the symphysis to the ensiform is uniform. The lower pole of the tumor may extend into and occupy part of the pelvis, and in this position be palpated through the vagina or rectum. The degree of mobility of the tumor is dependent on its attachment and the amount of fibrous tissue in the connective-tissue stroma. It may be attached over a large area, but the loose connective tissue of the fatty tumor allows it to be freely movable and for this reason it may be easily mistaken for an

intra-abdominal tumor. The clinical diagnoses in our cases are given in Table I (see pages 1462-1463).

It is noteworthy that the percentage of error in the clinical diagnosis of retroperitoneal lipoma is very high. Morgagni cites a case from the records of Valsalva of a necropsy on a woman, aged sixty years, who had complained for many months of a tumor in the umbilical region as large as the uterus in a pregnant woman can be. On opening the abdomen after death the base of the large tumor was found in the center of the mesentery and connected with the adipose membrane of the right kidney. "The substance of the tumor was firm in some places, but in others rather soft as not resemble meaty matter."

The earliest case of retroperitoneal lipoma in which operation was performed was reported by Lizars in 1811. The woman had had an enlargement of the abdomen for nine years. At first her physicians considered her to be pregnant; later Lizars made a diagnosis of disease of the ovaries, and was urged by his patient to operate. Encouraged by the knowledge that arctomy had been performed successfully in America by Al Dorell (whom he refers to as Mackowall) he attempted to relieve the woman by an operation. However he did not find the condition he had anticipated. The uterus and ovaries were perfectly sound but there was a flattened tumor at the left sacral isthmus, lying beneath the division of the common iliac artery which he refers to as density of the intestines.

That retroperitoneal lipoma may be mistaken for tumors of the ovary, uterus, kidney, supracardiac pancreas, spleen and so forth or for a pregnancy is evidence of the fallibility of clinical diagnosis, but tumors of these organs or pregnancies at such cause signs and symptoms due to displacement of function which would be sufficient to indicate them.

If a lipoma in the region of the kidney is small or of moderate size and located in the perinephric tissues it may easily be mistaken in position for the kidney or for a tumor of the kidney. Also a large lipoma arising from the perinephric fat may cover the anterior surface of the kidney and form a mass so thick that the entire growth may be diagnosed tumor of

the kidney. Urologic methods of diagnosis must be used to exclude such tumors as hypernephroma, polycystic kidney, hydronephrosis, and perinephric abscess.

Simple ovarian cysts should be differentiated by their spheric or ovoid shape, smooth surface, attachment in the pelvis, and consistency. They are tense and do not give a doughy feeling on pressure. However, they resemble retroperitoneal lipomas more closely than any other tumor of the abdomen.

A large lipoma high on the left side may be mistaken for the spleen, but careful palpation showing the absence of a well defined border with a notch should rule out the spleen. The tumor is less hard than the spleen in most cases of splenomegaly. The clinician will be aided by the blood-picture, but if the patient has had bloody stools over a long period, as in one of the cases in our group, the presence of a tumor with the blood findings of a secondary anemia may mislead the clinician.

Mesenteric and retroperitoneal cysts are so uncommon and the diagnosis is so obscure that an abdominal exploration is necessary to clear up the diagnosis.

Magoun has reported finding retroperitoneal fibromyomas in the same location as retroperitoneal lipomas. Fibromyomas are much firmer than lipomas, but the symptoms they produce are as indeterminate as those of lipomas.

Retroperitoneal sarcomas in the abdomen that attain the size these tumors usually attain before they cause symptoms would be hopelessly inoperable. The sarcoma is very hard, firmly fixed to adjacent structures, and the patient is emaciated and cachectic. Lipoma may undergo sarcomatous degeneration, as in 2 of our cases, and if the patient is operated on before the malignancy has extended beyond the tumor mass he may be cured.

ETIOLOGY

The etiology of retroperitoneal lipomas, like lipomas elsewhere in the body, is unknown. Nothing could be found in the records of our cases of a possible cause, but it is of interest to note that in 2 of our cases the lipoma arose from the perinephric fat following an exploration of the kidney for stone

and removal of the kidney. Two of our patients gave histories of injury, one due to a fall, the other caused by lifting.

OPERATION

Many of the cases reported in the literature were incorrectly diagnosed as tumors of the kidney and some type of incision for operation on the kidney was made. In two of the operations in the Clinic the Mayo lateral incision was made. In both cases the tumor was small and while no record was made of the steps of the operation, it is reasonable to suppose that the removal was difficult, since the tumors were located anterior to the kidneys and the pedicles with the blood-supply were there for the presenting parts of the tumors.

In deciding the type of incision to use, the important consideration is the attachment of the tumor and its relations to the blood-vessels. Generally it is easy to determine fairly accurately the point of attachment of small tumors, but often it is impossible to find the origin of larger tumors (weighing more than 6 or 7 kg) since the abdominal viscera may be displaced and the tumor lying in the midline. In such cases a long transperitoneal middle line incision is advisable unless there is a definite history of the tumor having been palpable on one side only when it was smaller. If the tumor arises from either flank it will be found on opening the abdomen that the lateral part of the colon from that side is carried forward by the neoplasm while the part of the colon on the opposite side of the abdomen lies behind. This was demonstrated in Case A228,249 in which the lipoma, weighing 9.75 kg, originated in the perinephric fat on the left side. The descending colon and sigmoid were found on the anterior surface of the growth and the cecum and ascending colon were posterior in their normal positions. Most of the tumors originate in the perinephric fat and may be removed most satisfactorily through a straight rectus incision long enough to give satisfactory exposure. If the tumor originates on the right side the peritoneum forming the outer attachment of the cecum and ascending colon should be cut freely and the right half of the colon with its blood-supply intact should be rolled toward the middle line. After

small amount of peritoneal fat has been separated the capsule of the fatty tumor is exposed and, unless degeneration has resulted from interference with the blood-supply it may be shelled out much like encapsulated lipomas in other parts of the body. If the tumor is located on the left side the procedure is the same except that the descending colon is the displaced viscus. When degeneration has taken place and has extended to the capsule the procedure is much more difficult, since it is impossible to find a line of cleavage and much dissection may be necessary close to and often surrounding such important structures as the renal, splenic, or mesenteric vessels, the ureters, and on the right side, the second part of the duodenum. In some cases tongue-like projections may be found running between the spinal column and the great vessels, and if they are not well encapsulated and free from adhesions they may make the operation one of very serious magnitude. The blood-supply to the tumor itself as a rule is in a small pedicle which is easily secured after the tumor is entirely freed.

Removal of a tumor that is attached in the base of the mesentery close to the middle line presents unusual difficulties on account of its intimate relations with important vessels. In many cases the mass is divided into two or more apparently distinct tumors by deep grooves in which the vessels lie. Great care is necessary in these cases not only to avoid injury to the vessels but also to remove all the tumor tissue, as there is a marked tendency for such tumors to recur. One patient (Case A24 651) was operated on four times in the Clinic during eleven years, and lipomatous tissue weighing altogether 23.70 kg. was removed on an average of 5.92 kg. for each operation. Another patient (Case A291,541) was operated on twice. At the second operation the recurrent tumor was found to be a sarcoma.

After removal of the tumor great care should be taken to make the field of operation dry as bleeding from even a small vessel may result in the development of a large hematoma in the cavity. It is very desirable in such cases to close without drainage.

Probably the greatest postoperative danger in the non-

infected cases is the development of intestinal obstruction, although we had no such complication in our 12 cases. To avoid this it is advisable accurately to resuture the opening made in the peritoneum and to leave as little raw surface as possible.

MORTALITY

The mortality should be very low in the uncomplicated cases but in the presence of degeneration or infection the operation may prove to be very serious. There were 2 deaths among our 12 patients. In one patient an abscess in the center of the lipoma, which weighed 2 kg. communicated with a sinus in the back which had persisted since exploration elsewhere of the kidney on that side some months previously. The other patient had a small tumor weighing 205 gm., but it was very cellular and firmly adherent to surrounding structures as the result of degeneration. In the attempt to remove it several large vessels were cut and, although the amount of blood lost on the operating table was not considered excessive, the patient was much shocked by the operation and, in spite of transfusion, died the following day. Necropsy revealed the fact that bleeding had continued from a small vessel after the abdomen had been closed.

PATHOLOGIC FINDINGS

Most retroperitoneal lipomas have been found to arise from the anterior surface of the perinephric fat, but they may be found at any place in the retroperitoneum of the abdomen or pelvis and in the mesentery (see Table 1 pages 1462-1463). The attachment is sessile and may diffuse itself into the fatty tissue from which it arises. By gravity a lipoma arising from the fatty tissue in the retroperitoneum of the abdomen may wander into the pelvis. Similar tumors are found in the omentum and peritoneum.

In 4 of our cases the lipoma was degenerating, and in these tumors areas of necrosis were found in the central portion of the tumor. They were soft and grayish. Two lipomas had undergone a sarcomatous change and one contained an area of degeneration which grossly appeared to be myxosarcoma.



Fig. 635.—(Case A135,109) Retroperitoneal lipoma; fatty area made up of fat globules in loose connective tissue stroma ($\times 50$)

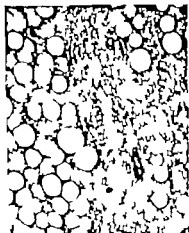


Fig. 636.—(Case A310,615) Retroperitoneal lipoma; fibrofatty area made up of fat globules in dense connective tissue stroma ($\times 50$)

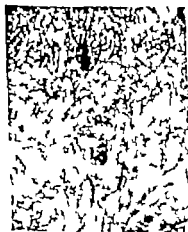


Fig. 637.—(Case A101,319) Fibrosarcomatous area in retroperitoneal lipoma ($\times 50$)

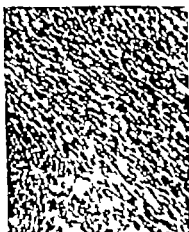


Fig. 638.—(Case A229,340) Sarcomatous area in retroperitoneal lipoma. Many mitotic figures may be seen ($\times 100$)

TABLE 1

DATA IN 13 CASES OF RETROPERITONEAL LIPOMA

Case No.	Age, Sex	Duration of symptoms	Chief diagnosis	Date of operation	Site, extent and location of tumor	Weight or size	Pathologist's diagnosis
869 N. 7/5	77 M	years	Abdominal tumor. Miliary (?)	3/24/71	Peri-umbilic fat in the right side.	9 cm. in diameter	Lipoma.
234 A. 4/79	49	year	Ovarian tumor. Retroperitoneal lipoma, over ovary. Retroperitoneal lipoma, over ureter. Retroperitoneal lipoma, over aorta.	6/18/79 7/24/79 8/24/79	Peri-umbilic fat in left side extending into secondary vesicle of vena cava in the right side. One mass posterior to the under surface of the lumbar flexor; one small mass in secondary of the transverse colon. Growing from the secondary above over the vena cava, extending the great blood-vessel.	80 kg. 30 kg. 7 kg. 40 kg.	Lipoma; the central portion is myeloid. Lipoma. Lipoma.
29 7/26/71	54	years	Large subcutaneous cyst, ovary	7/26/71	Growing from the secondary of the small intestine and the fat around the right kidney.	60 kg.	Lipoma, degeneration.
77 228 2/5	59 M	months	Abdominal tumor, over 17 in. in width	12/12/71	Within the mass is the right flexor.	60 gm.	Lipoma.
54 447 26/13	54	years	Tumor of left kidney cyst of the lower pole (?)	7/26/73	Back of the left kidney, extending into the transverse flexor.	208 gm.	Myeloid lipoma.
19 109 7/13	49	years	Spontaneously ruptured aneurysm.	7/13/73	Region of the left kidney filling the upper left abdomen.	3 27 kg.	Lipoma.
237	40	months	Peri-umbilic cyst, per cyst abdominal peritonitis, 25 per cent.	4/71	Anterior surface of the right kidney.	3 26 kg.	Myeloid lipoma.
240 249 5/7/73	6 M	year	Retroperitoneal aneurysm.	1/20/73	Peri-umbilic fat in the right side.	8 kg.	Lipoma.

Case No. Date	Age Sex	Duration	Abdominal tumor	Date	Location of tumor	Weight	Pathologic description
279,349 4/27/71	41 M.	month	Inflammatory mass in the left side of the abdomen (retroperitoneal lipoma) (1), retroperitoneal lipoma, necrotic	10/ 3/	Lower pole of the right kidney	90 kg.	Degenerating myxosarcoma, epithelial in lipoma.
279,351 4/27/71	41 M.	month	Inflammatory mass in the left side of the abdomen (retroperitoneal lipoma) (1), retroperitoneal lipoma, necrotic	10/ 3/	Peritoneal tumor on the left side of the left kidney	15 X 8 X 5 cm. X 0 cm. cm. in diameter	Myxosarcoma with some fatty cellular areas. Area of necrosis in center.
281,798 7/17/70	44 F.	7 years	Retroperitoneal mass, retroperitoneal lipoma	1/27/70	Left side of spine just below the kidney	136 gm.	Myxosarcoma.
281,815 2/29/70	42 F.	year	Mass in the right side of the abdomen.	4/ 3/70	Right peritoneal fat. Firmly adherent to the right side where kidney had been removed	60 kg.	Infected lipoma with abscess

The size and weight of the tumors in the group we are reporting varied considerably one weighed only 60 gm., while the heaviest weighed 9.5 kg. Hirsch and Wells reported one weighing 69 pounds.

Microscopic Findings.—In the fatty areas the sections show numerous large fat-cells, round or oval and with a peripheral nucleus. Between the fat-cells is a fine loose, connective-tissue stroma (Fig. 635). The amount of connective tissue varies in different lipomas and in sections from different areas of the same lipoma. Some areas are very fibrous, resembling fibroma (Fig. 636). In some of the tumors the fibrous areas are very cellular and show marked activity of growth. In two lipomas in our group the cells in these fibrous areas had become malignant, and presented the picture of a sarcoma (Figs. 637-638). Sarcoma developing in lipoma has been reported by Schiller and others. In some cases the fibrous tissue is edematous and resembles myxoma. The blood-vessels pass through the connective-tissue stroma and are most numerous in the fibrous areas.

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THE TRANSPLANTATION OF FAT IN THE PERITONEAL CAVITY

FRANK C. MAXX

FAT has been transplanted in the peritoneal cavity for several purposes, the most important of which are (1) to prevent adhesions (2) to patch an opening pathologically or surgically produced in some part of the gastro-intestinal tract (3) to strengthen a suture line of the gastro-intestinal tract or the ureter (4) to replace lost peritoneum (5) to occlude a portion of the gastro-intestinal tract, and (6) to stop hemorrhage. The fatty tissue usually employed has been omentum in free and attached grafts, although subcutaneous fat has also been used.

In an attempt to evaluate the intraperitoneal transplantation of fat series of experiments extending over a considerable period of time have been carried out in the laboratories of the Division of Experimental Surgery and Pathology of the Mayo Foundation. The first series was performed by Dr. Gordon Bell in 1914 on the protection of a suture line of the ureteral anastomosis the second series by Dr. Stuart W. Harrington, on the use of fat to protect the suture line of gastro-intestinal operations and its value in preventing hemorrhage from such organs as the liver, spleen, and kidney and the third series by Dr. Thomas Kinsella, in order to determine the fate of the transplanted fat when used under various conditions.

For several years I have been carrying on experiments in which fat has been used in connection with operations for various purposes. At necropsy special note has been made with regard to the prevention or production of adhesions by the transplanted fat.

Considerable work has been done on this subject. The most important reports have been presented by the following authors

Senn, Braun, Sundholm Thetze Enderlen Loewy Zilocchi, Gergolaff Neumann, Neuhof and Wiener Springer Richardson, Sweet, Chaney and Wilson, Freeman, Corbett, Davis, Mayo, Finton and Peet. In a careful review of their work a wide variety of *clinical and experimental results and conclusions* is noted. By anticipating somewhat our results we can, I believe, explain these contradictions. With regard to clinical data on the subject there do not seem to be any necropsy reports in cases in which the omentum had been transplanted. Because the patient did not develop symptoms referable to the transplantation the surgeon recorded the results of the procedure as good. Whether or not the results of the experimental investigations were good or bad seem from our experiments, to depend on the *individual variation in the reaction of the peritoneum and on the technical care in effecting the transplantation.*

Our experimental work was done with two objects in view the determination of the actual fate of the transplanted fat and the results produced, and the application of the procedure to clinical surgery. It is not enough that such a transplant remains viable or prevents adhesions. It must also give reasonable promise of being adaptable to clinical surgery in order to be of value.

As Williamson and I have pointed out, it is difficult to standardize experimental procedures in the peritoneal cavity because of the marked individual variation of the reaction of the peritoneum. For practical purposes, therefore, we carried out our observations on the effect of intraperitoneal transplantation of fat in connection with a large number of operations for the primary purpose of other investigations. In this manner we have relied for our conclusions on a large number of observations under various experimental conditions and following a varied technic.

FIRST SERIES: THE USE OF FREE TRANSPLANTS OF OMENTUM IN THE PERITONEAL CAVITY

To Prevent Adhesions.—Free grafts of omentum were used under many experimental conditions in order to prevent

adhesions in the peritoneal cavity. In general the results were quite definite. In most instances in which the free omental graft was used to prevent adhesions more adhesions were found at necropsy than if a transplant had not been used. If however infinite care was used in handling the transplant, so that the delicate cells would not be injured and in tucking in the edges so that none of the cut surface was exposed it was found to be possible to cover a traumatized area so that few if any adhesions occurred.

To Patch an Opening in Some Part of the Gastro-intestinal Tract.—In some experiments an opening made by the knife or the cautery into the stomach or intestine was partially or completely sutured and the sutured area was covered by a free transplant of omentum. In these experiments very little evidence was obtained to indicate that the free transplant of omentum was of much value in preventing leakage into the peritoneal cavity from such an opening. Certainly the transplant was not so valuable as a careful closure by suture and in order to fasten the patch securely and at the same time prevent it from producing too many adhesions as much time was consumed as in carefully suturing the opening.

To Strengthen a Suture Line of the Gastro-intestinal Tract or the Ureter.—After the completion of an anastomosis in the gastro-intestinal tract or in the ureter a free transplant of omentum was sutured over the line of anastomosis. In this case also such a procedure is of questionable value and certainly in no wise compensates for the careful employment of the usual suture line. The transplantation of free omentum cannot be recommended in place of the second suture line of a gastro-intestinal operation.

To Replace Lost Peritoneum.—A free transplant of omentum is sutured over an area from which the peritoneum had been removed and carefully sutured in position, no cut edges being left exposed in the peritoneal cavity replaces the lost peritoneum to a certain extent. Again, it should be emphasized that unless great care is exercised in transplanting the omentum the adjacent organs will become adherent to the site of transplantation over a larger area than if the transplant had not been used.

To Occlude a Portion of the Gastro-intestinal Tract.—A portion of the gastro-intestinal tract, such as the pylorus, could be occluded partially by suturing in a free transplant of omentum.

To Stop Hemorrhage.—In some experiments following trauma to the liver kidneys, or spleen a detached tag of omentum was packed into the wound. This procedure was successful in stopping the hemorrhage and at necropsy the areas were found to have healed nicely and certainly no more, if as much, damage had been done than if the hemostasis had been effected by other means.

SECOND SERIES: THE USE OF ATTACHED TRANSPLANTS OF OMENTUM IN THE PERITONEAL CAVITY

To Prevent Adhesions.—When the edge of the omentum not in any way detached from its blood-supply was loosely sutured over any traumatized area in the peritoneal cavity the omentum adhered firmly to the traumatized area and thus prevented any of the adjacent organs from adhering also to this area. In this respect the attached omentum can be used to prevent adhesions other than those between itself and the traumatized area.

To Patch an Opening in Some Part of the Gastro-intestinal Tract.—It was proved quite conclusively that the attached omentum sutured over an opening in the gastro-intestinal tract was of great value in preventing leakage from the lumen of the intestine into the peritoneal cavity. While it is questionable whether such a method of patching an opening in the gastro-intestinal tract should ever be employed when it is possible carefully to suture the opening it is of value to know that the omentum can be of service in closing such an opening.

To Strengthen a Suture Line of the Gastro-intestinal Tract or the Ureter.—Suturing the attached omentum over the suture line of the gastro-intestinal anastomosis greatly strengthened it.

To Replace Lost Peritoneum.—The attached omentum sutured over denuded area of peritoneum prevented adhesions of other organs to this denuded area.

To Occlude a Portion of the Gastro-intestinal Tract.—Partial or complete occlusion was produced by suturing the

attached omentum around a portion of the gastro-intestinal tract, such as the pylorus.

To Stop Hemorrhage.—The attached omentum packed into a traumatized area of the liver kidney or spleen produced complete hemostasis.

THIRD SERIES: THE USE OF SUBCUTANEOUS FAT

Subcutaneous fat was used in the same manner as omentum. The results from the intraperitoneal transplantation of subcutaneous fat differed very little from those obtained with the free transplant of omentum.

SUTURE MATERIAL

Our observations tend to show that fine silk is the preferable suture material to hold the omental transplant in position because it produces the least reaction. However fine catgut carefully used is also satisfactory.

CONCLUSIONS

1 Our experiments seem to indicate that the free omental transplant has a very limited application in surgery of the peritoneal cavity. The greatest benefit from its use seems to be in stopping hemorrhage from a parenchymal organ. In this respect it seems fully as good as the attached omental transplant.

2 A free transplant of omentum in the peritoneal cavity may remain seemingly viable for as long as one year and retain some although only a small percentage of its fat. In many instances however after a few weeks the transplant is reduced to an almost fat free scar-like tissue.

3 By exercising great care it is possible to use a free omental transplant to prevent adhesions, but the value of such a procedure is greatly decreased by the fact that unless infinite care is exercised the results in all probability will be worse than if the transplant had not been used.

4 A free transplant of omentum is not safe for routine use in patching an opening of the gastro-intestinal tract.

5 While a free transplant of omentum may be of some value in reinforcing the suture line of a gastro-intestinal anastomosis, it does not compensate for the careful use of the regular method of suture, and probably is of no advantage.

6. A free transplant of omentum can be used partially to replace lost peritoneum, but the transplant is not so good as suture, and unless great care is exercised the results may be worse than if the area had been left denuded.

7 The gastro-intestinal canal can be occluded partially by a free transplant of omentum.

8. A free transplant of omentum packed into a wound of the liver, spleen, or kidney stops hemorrhage from the wound.

9 There is a wide range of possibilities for the use of the intact omentum in the peritoneal cavity providing care is exercised that such use does not furnish a basis for future intestinal obstruction.

10 An attached transplant of omentum can be used to prevent adhesions to patch an opening in some part of the gastro-intestinal tract, to strengthen a suture line of the gastro-intestinal tract, to replace lost peritoneum, to occlude a portion of the gastro-intestinal tract and to stop hemorrhage of a parenchymal organ. Of course, it is understood that the use of such an attached transplant of omentum carries with it the potentiality of producing intestinal obstruction.

11 All the statements made concerning the use of the free transplant of omentum are equally true with regard to subcutaneous fat.

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ACUTE CONDITIONS OF THE ABDOMEN

VERNE C. HUNT

Lesions of the abdomen may be acute, subacute or chronic, according to the degree of severity and duration. An acute condition of the abdomen may be a sudden and severe exacerbation of a chronic lesion. Peritonitis may be chronic, as in tuberculosis of the peritoneum and usually acute peritonitis is the result of an invasion of the peritoneum by pyogenic bacteria.

In the successful management of acute lesions of the abdomen diagnosis is of as great importance as in chronic or subacute conditions. Unfortunately however the urgent symptoms of acute lesions forbid employing the various diagnostic procedures and methods and their deliberate correlation applicable to the chronic lesions. The diagnosis must frequently be made hurriedly on a few symptoms and findings which quite uniformly are manifested in the acute lesions. A carefully elicited history and the physical examination often must furnish the data on which the diagnosis is made and the choice of the procedure determined. Pain, nausea and vomiting, hemorrhage, constipation or diarrhea, and increased temperature, subjectively and facial expression, posture, the condition of the skin, pulse, rigidity and tenderness, objectively are the important manifestations in acute lesions of the abdomen.

Pain is the important symptom which often influences the diagnosis and procedure. Its location and manner of onset, its severity, radiation, duration and relation to other symptoms must be determined. The sequence of tenderness, nausea and vomiting, temperature and collapse is important. The character of pain, its location and severity may be quite characteristic for certain lesions. The pain of acute pancreatitis and

mesenteric thrombosis is usually terrific and often unrelieved by large doses of morphin.

Extra-abdominal conditions which so closely mimic acute abdominal lesions must be borne constantly in mind most prominent among these are the referred pain of pneumonia, particularly in children, pleurisy acute dilatation of the heart, gastric crisis of tabes dorsalis, herpes zoster and spondylitis. Besides the extra-abdominal lesions with acute abdominal symptoms are acute abdominal conditions that are not surgical, of which lead-poisoning and acute gastro-enteritis, angioneurotic edema, purpura and splenic infarct are examples. By careful history taking and examination such errors in diagnosis usually are avoided, at least the urgency of exploration is obviated and further investigation in questionable cases insured.

The history often shows that the acute lesion is an exacerbation or complication of a preceding chronic lesion. Acute perforations of gastric and duodenal ulcers are usually preceded by gastric disturbances, information concerning which, because of the patient's condition, it is often difficult to elicit. However very often after operation, when the true nature of the disorder has been determined, it has been possible to obtain a history typical or at least suggestive of ulcer immediately before or some time before. More painstaking histories obtained from the patient or his relatives will show an increased frequency of previous digestive disturbances in cases of perforated gastric or duodenal ulcer than has been noted in the past. Some observers have noted such disturbances in few more than 50 per cent. of these patients. At times the history includes acute exacerbations with epigastric pain severe enough to require sedatives these, in reality have been perforations with protective localization from which the patient has recovered spontaneously. The residue of this is frequently seen at the operating table in cases of so-called chronic perforation on to the pancreas, inferior surface of the liver or gall-bladder. As W. J. Mayo has pointed out the anatomic surroundings of the gall-bladder are excellent for protection the parietal peritoneum, the under surface of the liver the transverse colon, and the omentum all combine to

localize the contaminating material which may escape from the perforated viscus. Likewise, the duodenum and the lesser curvature and the posterior wall of the stomach are so closely associated anatomically with the inferior surface of the liver and the pancreas that, in the event of perforation of the ulcer these structures serve as protection to the peritoneal cavity. In a review of 25 cases of chronic perforating ulcer of the stomach observed in the Clinic it was found that 17 had perforated on to the pancreas and 4 on to the inferior surface of the liver. Of 72 chronic perforating ulcers of the duodenum, 19 had perforated on to the inferior surface of the liver, 13 on to the gall-bladder and liver and 22 posteriorly on to the pancreas.

Deaver and others have discussed the tendency for cholecystic, appendiceal, and pelvic inflammation to localize. The localization of acute disease of the gall-bladder occurs by the same means of protection afforded the duodenum. The biliary attacks so typical of gall-stone disease are usually the source of little concern from the standpoint of life and death of the patient when they are of short duration, and it is only with their prolongation, impaction of a stone in the neck of the gall-bladder and resultant suppuration and gangrene that perforation is imminent. The residue and complications of perforations of the gall-bladder which usually are at the neck of the gall-bladder as a result of gangrenous ulceration from stones, are found fairly often during operation in the form of fistulas into the duodenum or colon, or persisting subhepatic or subphrenic abscesses. The process usually is preceded by sufficient inflammatory reaction so that neighboring structures become attached to it and seal the perforation before contamination occurs. At times this results in the discharge of the contents of the gall-bladder into its neighboring adherent viscus and in a fistula into the duodenum or colon. Often the ulceration is toward the liver and results in the escape of stones and infective material into the liver. Spontaneous non-traumatic perforation of the gall-bladder with contamination by bile of the general peritoneal cavity is exceedingly rare. It has been observed in but 4 cases in 11,000 cases of gall-bladder disease in the Clinic. Subphrenic abscess and fistula

into the duodenum and colon are more often met with. The extreme rarity of perforation of the gall-bladder and contamination of the general peritoneal cavity justifies treating symptomatically acute gall-bladder disease and deferring operation in most instances until the acute symptoms have subsided.

The differential diagnosis of acute pelvic conditions embraces acute salpingitis, acute appendicitis, rupture of an ectopic pregnancy twisted pedicle of an ovarian cyst, and intestinal obstruction. In these cases also the patient's description of the attack the information obtained by asking direct questions concerning previous attacks, menstrual disorders, exposure to infection, and determining the sequence of the manifestations of the onset together with careful physical examination, including bimanual and rectal palpation, usually approach accuracy of diagnosis and form the basis of judgment of whether or not the condition is immediately surgical or is best treated conservatively.

Generally by correlation of symptoms and findings a fairly accurate diagnosis of an acute condition of the abdomen can be made, but there are conditions in which no other preoperative diagnosis but "acute surgical lesion of the abdomen" can be made and the true nature of the condition revealed only on exploration. Of these, acute pancreatitis and mesenteric thrombosis are examples. If possible, differential diagnosis should be reached, for there are acute lesions of the abdomen that are best not subjected to immediate operation, among which are acute diseases of the gall-bladder and pelvic inflammation. In some cases of acute lesions of the abdomen operation must be performed not for the primary lesion, but for its effect, such as peritonitis following perforation of a viscus. At times it is difficult to determine the advisability of operation the diagnosis may be quite certain, but the generally poor condition of the patient may contraindicate operation.

W J Mayo has called attention to the fact that in perforations of abdominal viscera, after contamination has passed into peritonitis, the most important factor is the peritonitis, and the so-called early operation is not related in time to when the surgeon sees the patient, but to the time when the perforation took

place Deaver has likewise stated that early operation refers to the stage of the disease and not to the time the patient is seen by the surgeon. The patient, at the time he is first seen, may no longer be suffering from the original lesion, but from its effect, such as peritonitis following perforation, hemorrhage of an ectopic pregnancy gangrene or toxemia from a strangulated hernia.

The effects on the peritoneum of perforations have been divided into the stages of contamination, of reaction and of general peritonitis (W. J. Mayo). A very high percentage of patients can be saved if operation is performed in the stage of contamination, and a very small percentage if operation is performed in the stage of progressive peritonitis.

The stage of reaction may be spoken of as the stage of fatal improvement or betterment in which the pain and acute symptoms may subside and if the rigidity disappears, actual improvement may result. However persistence of rigidity in the presence of apparent improvement indicates progression, and operation should be performed. Overlooking rigidity in apparent improvement leads to postponing operation and allows the patient to pass into the stage of progressive peritonitis for which operation accomplishes little or nothing. While an appendix usually does not rupture within twenty four hours after the onset of symptoms, occasionally the entire peritoneal cavity is contaminated from perforation within such time and when the abdomen is opened flocculent, cloudy fluid escapes. In most of such cases the patient recovers after thorough drainage of the abdomen before true peritonitis develops. The results are as good following operations for perforations of gastric and duodenal ulcers when operation is performed within eight hours. However if the case has passed on to the stage of true peritonitis and resultant to emia, little may be accomplished by operation, and it is often better judgment to treat expectantly employing the Ochsner Murphy method in the hope that the infection may become localized, particularly in acute cholecystitis, pelvic infections, and late general peritonitis.

The question of the advisability of operating in acute conditions of the abdomen is not always easy to decide. Most of

us some time have been called in to see a case of what appeared to be acute appendicitis with the classical symptoms and manifestations of the disease, and we have advised operation, at which an apparently normal appendix was found and general abdominal exploration revealed no other cause for the symptoms the patient recovered and had no further attacks. These early operations are justifiable however since in the majority of cases a pathologic condition is found. Many of the patients, if treated expectantly would recover spontaneously but a fair percentage would develop general peritonitis. Furthermore operation performed on the preoperative diagnosis of appendicitis of only moderate severity occasionally leads to finding a ruptured ectopic pregnancy perforated viscus, or volvulus of the intestine.

The detailed consideration of the treatment of the various types of acute conditions of the abdomen is hardly within the scope of this paper. However a few of the general principles applicable to these conditions require particular emphasis. No non-traumatic acute lesion of the abdomen is so urgent as to justify waiving a painstaking history careful physical examination, the examination of the urine chemically and microscopically and an estimation of the hemoglobin and leukocytes in the blood. These procedures will immediately by exclusion, remove some of the possibilities in the differential diagnosis, and automatically with the consideration of the time element, classify the condition as immediately surgical or to be treated expectantly.

The element of time between the onset of the acute symptoms and the institution of treatment in itself is at times the sole guide in the choice of surgical or non-surgical methods. To consider an acute abdominal pain accompanied by manifestations of shock with a board-like abdominal wall a surgical condition irrespective of the consideration of the time between the onset and time that the patient is seen courts disaster and is accompanied by a high mortality rate charged up to surgery and more destructive of life than the employment of non-operative methods in the selected cases in which the patient is no longer suffering from the primary lesion but its effects. It is

known that operations for acute perforations, including those of the appendix, within the first twelve hours or still within the stage of contamination, are accompanied by a low mortality rate and a high percentage of recoveries, while with the advancement of time beyond the twelve-hour period the percentages rapidly reverse and operation after thirty-six hours in the stage of progressive peritonitis, marked by the distended silent abdomen, persistent vomiting rapid thready pulse and mental acuteness of the patient, is accompanied by a high death-rate and a small percentage of recovery. It is to these cases of spreading peritonitis that the Ochsner Murphy method of treatment is particularly applicable and many times carries a patient through who would have succumbed to the slightest surgical intervention. Fluids given by rectum or subcutaneously morphin in sufficient amounts to afford quiet and comfort to the patient, and the frequent application of hot packs to the abdomen has been the treatment of spreading peritonitis for years in the Clinic. It conserves strength and aids localization, for which the patient may often be operated on in forty-eight or seventy-two hours, or later with safety and benefit.

Excluding control of intra-abdominal hemorrhage as a result of an acute intra-abdominal lesion, surgery accomplishes little in the advanced effects of the primary acute lesions of the abdomen and reacts to the discredit of the method which in itself is not at fault, but its time of application is responsible.

Among acute postoperative conditions are hemorrhage peritonitis, and intestinal obstruction. The true peritonitis of hemolytic streptococcus origin is little benefited by drainage. At times, however a low-grade peritonitis, of which recently we have observed 2 cases following vaginal hysterectomy is benefited by abdominal drainage. One of these cases was due to a gas-producing organism with great extra-intestinal distention of the abdomen, which was immediately relieved by a small incision and insertion of drains. Postoperative paralytic ileus is often due to a low-grade peritonitis. In some of these cases enterostomy is a life-saving procedure.

Increased accuracy in the diagnosis of chronic abdominal

lesions is due largely to the Roentgen ray particularly in lesions of the gastro-intestinal tract, but in many conditions the diagnosis must be arrived at by correlation of symptoms and findings only when as yet the surgeon cannot be assured that in a particular case there is but one lesion in the abdomen, so that an incision which facilitates the work of a preoperative diagnosis only should not be used. In operating for chronic lesions of the abdomen, coexisting lesions in the stomach, appendix, and gall-bladder are often found, and this reason alone is sufficient to make the McBurney incision a relic. Its present usefulness is limited to operations on the appendix in children and the drainage of abscesses and performance of enterostomy and colostomy in adults. The frequency with which multiple lesions are found in chronic conditions justifies an incision sufficiently large and located so that, in the absence of general contraindications, general abdominal exploration is facilitated. For the same reason such an incision is of equal importance in acute conditions of the abdomen in the absence of general peritonitis, and the general abdominal exploration usually should be made before the examination of the suspected lesion. In this manner a good view of the stomach and duodenum gall-bladder and intestinal tract, if necessary may be obtained in addition to palpation. Much may be learned by palpation of the stomach, gall-bladder spleen, liver pelvic organs, and kidneys. Even though the ureters cannot be felt readily the fingers in their passage over them will be arrested by the presence of a small stone which did not show in the roentgenogram. Finding associated lesions in the abdomen or correcting a preoperative diagnosis makes general exploration in acute abdominal conditions justifiable in the majority of cases.

Points as follows should be emphasized

1. A painstaking history and careful physical examination in all cases will avoid operating in cases of non-surgical acute lesions of the abdomen.

2. Early operation, within the first twelve hours or during the stage of contamination following perforations is followed by a high percentage of recoveries later there is often reaction

during which the patient may still be operated on. In the stage of progressive peritonitis, with the distended "silent" abdomen, quick pulse and mental alertness, operation accomplishes little or nothing and is often destructive to life that may be conserved by non-surgical methods to aid localization and conserve the strength of the patient until his condition is so changed that a late operation may be performed with safety and benefit.

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INCISIONS IN THE KNEE-JOINT

MELVIN S. HENDERSON

THE stability and efficiency of the knee-joint are sources of constant wonder when the structure of its bony components is considered. The absence of bony prominences and corresponding depressions requires a most ingenious system of ligaments. In making incisions in the knee-joint therefore the surgeon should possess a definite knowledge of the location of these ligamentous structures, especially when it is important not to interfere with function.

From the point of view of the surgeon the knee-joint may be considered as consisting of an anterior and a posterior compartment. The anterior compartment consists of the suprapatellar pouch and the part of the joint between the bones and beneath the patella. The posterior compartment is a smaller space not so frequently of surgical importance as is the anterior. It includes the intracapsular portion of the knee joint behind the posterior tibial spine and is bounded anteriorly by the condyles of the femur and posteriorly by the posterior capsule. Some of the more usual surgical conditions of the knee-joint are mechanical derangements due to fractured or torn semilunar cartilages, loose osteocartilaginous bodies, tuberculosis, the infectious arthritides, and bony ankylosis.

Although the crucial ligaments are the main support of the knee joint, the muscular action of the powerful quadriceps extensor and the hamstrings is also extremely important. The internal lateral ligament is important, but cannot be demonstrated definitely at operation and, in reality consists of the entire internal capsule. On the other hand the external lateral ligament is definite and is easily demonstrated, but is placed well back of the region where any of the incisions to be described are made.

of the internal condyle and is carried down over the joint line. The capsule may then be opened, and the internal semilunar cartilage examined care being taken that no more of the internal capsule is cut than is essential to the proper examination of

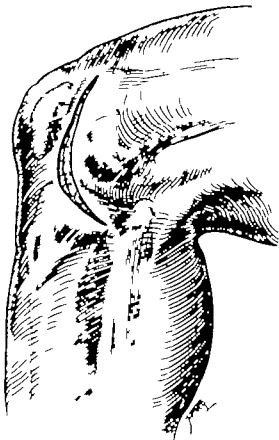


Fig. 640.—Anterior external incision for removal of external semilunar cartilage

the internal semilunar cartilage. The anterior external incision (Fig. 640) is similar to the anterior internal lateral incision and is used for the removal of the external semilunar cartilage, occasionally loose. These incisions may also be used for

ANTERIOR INTERNAL AND ANTERIOR EXTERNAL INCISIONS

The internal semilunar cartilage is quite often the cause of mechanical derangement of the knee-joint, and in the large majority of cases the condition is due to a fracture or a tear in

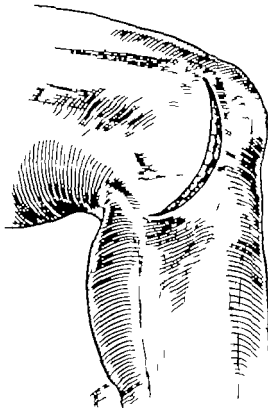


Fig. 639 —Anterior internal incision for removal of lateral semilunar cartilage

the meniscus. In these cases the anterior internal lateral incision is preferred (Fig. 639). The knee, flexed almost to a right angle hangs over the end of the table, the patient being in slight Trendelenburg position. The incision is begun opposite the upper end of the patella, more or less closely follows the curve

By flexing the joint a splendid exposure of the anterior compartment is assured. This incision, however is not so convenient for the removal of the semilunar cartilages as is the anterior internal or anterior external incision. When a thorough search for loose bodies or any repair of crucial ligaments is indicated this incision is the one of choice. The reaction following its use is surprisingly slight.

EXTERNAL POSTERIOR LATERAL AND INTERNAL POSTERIOR LATERAL INCISIONS

When the loose bodies are in the posterior compartment posterior lateral incisions are preferable to the incision described

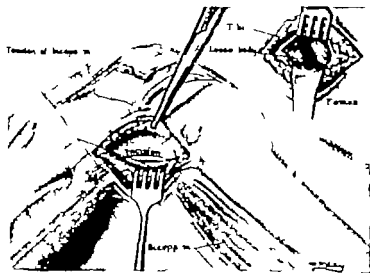


Fig. 642.—External posterior lateral incision. Insert shows loose body

years ago by Brackett and Osgood. The knee is flexed to a right angle thus relaxing the posterior capsule and the foot of the table is not lowered as in the anterior incisions (Figs. 642-643). The posterior lateral incision either on the inner or outer side or both offers an excellent opportunity for exploration

the removal of loose bodies in the anterior portion of the joint, but are somewhat limited in their possibilities for exploration.

SPLIT PATELLA INCISION

The split patella incision described a number of years ago by Corner is a long midline incision of about 15 to 20 cm. (Fig.

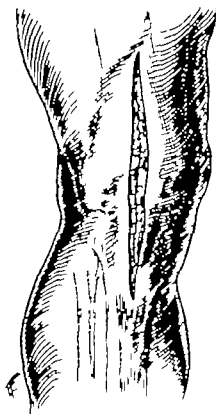


Fig. 641—Split patella incision for search for loose bodies or repair of crucial ligaments.

641) The patella is sawn through, the suprapatellar pouch opened, and the alar ligament or infrapatellar fat pad divided.

By flexing the joint a splendid exposure of the anterior compartment is assured. This incision however is not so convenient for the removal of the semilunar cartilages as is the anterior internal or anterior external incision. When a thorough search for loose bodies or any repair of crucial ligaments is indicated this incision is the one of choice. The reaction following its use is surprisingly slight.

EXTERNAL POSTERIOR LATERAL AND INTERNAL POSTERIOR LATERAL INCISIONS

When the loose bodies are in the posterior compartment posterior lateral incisions are preferable to the incision described

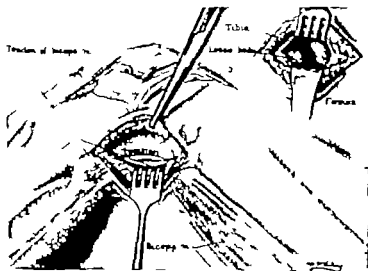


Fig. 642.—External posterior lateral incision. Insert shows loose body

years ago by Brackett and Osgood. The knee is flexed to a right angle, thus relaxing the posterior capsule, and the foot of the table is not lowered as in the anterior incisions (Figs. 642, 643). The posterior lateral incision either on the inner or outer side or both, offers an excellent opportunity for exploration

of the posterior compartment, since a view is obtained of the midline but owing to the fact that there is a mesial septum which connects the posterior capsule with the tibial spine and crucial ligaments, posterior lateral incisions on both sides are often necessary. The incisions are small and inflict less trauma than do instruments forced through to the opposite side of the posterior compartment, as would be necessary if the entire posterior compartment were to be explored through one incision.

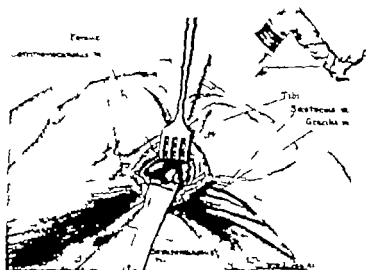


Fig. 643.—In small posterior lateral incision. Insert above. Line flexed to the right angle and the position of the leg on the operating table.

If it is desired to drain septic knee the internal or external posterior lateral incisions provide excellent drainage but they should not be depended on to drain the entire joint.

If loose bodies can be palpated and definitely located a small incision may be made anywhere in the joint. Under a local anesthetic a sharp needle may be forced through the skin transfixing the body and thus holding it in position. The knee is carefully prepared and dissection carried down to the body.

INCISION FOR RESECTION OF THE KNEE JOINT

For resection of the knee-joint excellent exposure is secured by a semicircular incision starting about on a line with the posterior border of the knee-joint and extending across to the

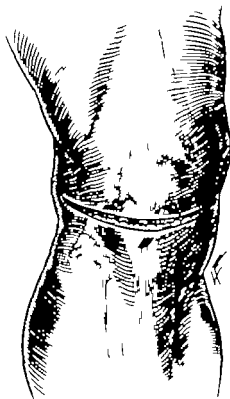


Fig. 644.—Incision for resection of the knee-joint.

same point on the opposite side severing the patellar ligament (Fig. 644)

INCISION FOR ARTHROPLASTY

Although arthroplasty of the knee-joint is rarely indicated the recent work of Putti and Campbell emphasizes the fact

that good results can be obtained. The incision described by Putti (Fig. 645) I believe, gives excellent exposure. It consists of a longitudinal incision in the midline extending upward from the patella for about 10 or 12 cm. the incision is then carried on in the form of an inverted Y running down each side of the

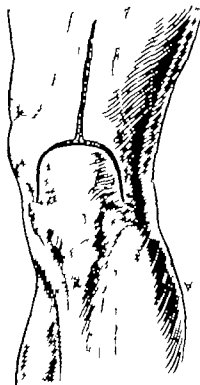


Fig. 645.—Incision of Putti for arthroplasty

patella to the joint line laterally. The patella is turned downward, the ligamentum patellæ not being molested.

RÉSUMÉ

1 The anterior internal and the anterior external lateral incisions are the incisions of choice for exploration and removal

of the semilunar cartilages. They are also of use for limited exploration of the knee-joint, such as removal of loose bodies, tissue for examination and so forth.

2 The midline split patella incision is of use when a free exploration of the anterior compartment is necessary or when repair of the crucial ligaments is undertaken.

3 The internal and external posterior lateral incisions with the knee flexed are the incisions of choice for the exploration of the posterior compartment, and afford excellent drainage for a septic knee.

4 The straight transverse incision across the patellar ligament is the incision of choice for resection of the knee-joint.

5 The inverted Y incision (Putti) with the arms reaching down each side of the patella is convenient in an arthroplasty

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CLINIC OF DR. HENRY W. MEYERDING

- I. Hemorrhagic Cyst of the Upper Left Femur
- II. Hemorrhagic Cyst of the Upper Right Femur
- III. Osteomalacia.
- IV. Non-union of the Left Tibia Associated with Syphilia.
- V. Periosteal Sarcoma Involving the Right Knee-joint.

CASE I (A219, A36)

N. B. a boy aged eight years, was examined at the Clinic January 23 1918. Six months previously the child had been kicked in the hip by a cow. He did not complain of pain afterward but he limped at times. While sking about five months later he fell and a physician declared the leg had been broken. The child was taken to a hospital, where x-ray examination showed a diseased condition of the bone. A definite diagnosis was not made, sarcoma, tuberculosis and cyst being considered and he was referred to the Clinic.

The examination showed enlargement of the left thigh its circumference being 4 cm. greater than that of the right there was no shortening. There was pain on deep pressure. The teeth were decayed and the tonsils and cervical glands were enlarged. The specific gravity of the urine was 1.019 the urine was acid in reaction and contained a few granular casts. The roentgenogram showed a large cyst of the left femur probably hemorrhagic.

Operation was performed January 31 1918. The cortex of the left femur was so thin and soft it could be cut with a knife. A large cavity about 11 cm. in length and 3.5 cm. in diameter filled with a serous mahogany-colored fluid and some old blood-clots, was broken into. There was no distinct lining membrane. A diagnosis of hemorrhagic cyst of the femur was made (Fig 646). The cavity was curetted and part of the cortex turned into

it. The periosteum was sutured and the wound closed without drainage. The weakened cortex cracked a few days after operation producing a green-stick fracture which, with the leg in a



Fig. 644 —(Case A219,836) Left femur. Cystic degeneration of the left femur (single). The medulla is enlarged and the cortex thinned. The trabeculations are not typical of osteitis fibrosa, they are heavier at the edge of the cyst and do not run out but it.

plaster cast, healed without shortening. No recurrence has been reported in three years.

CASE II (A364,114)

M. G. a girl aged twelve years, was admitted to the Clinic July 8, 1921 complaining of pain in the right hip and upper thigh and difficulty in walking. There was a history of tuberculosis in the father's family. The patient's general health had always been good. Four years before she had fallen on the ice and sustained a slight injury to the upper thigh and hip. Tender-ness over this area continued at intervals and she limped slightly

at times. Two weeks before she had had a severe attack of sharp stabbing pain in the upper right thigh and was not able to walk for several days.

Physical examination revealed a well-developed and well-nourished girl. There was marked tenderness on pressure over the upper third of the right femur with slight pain on moving



Fig. 647.—(Case A364,114) Characteristic appearance of the hemorrhagic cyst in the upper third of the right femur. The irregular outline and rather clear center is due to the collection of fluid from the old hemorrhage.

the limb. Nothing abnormal could be felt and there was no limitation of motion at the hip-joint. No enlargement of the thigh had occurred and no shortening of the limb was detected.

Examination of the urine and the Wassermann reaction on the blood were negative. The hemoglobin was 60 per cent. and the leukocytes 10,300. The roentgenogram showed a tumor

Involving about 10 or 12 cm of the upper end of the right femur just below the trochanter and limiting itself to the medullary cavity. Roentgenograms of the other long bones were negative.

At operation the tumor was found to occupy the entire medullary cavity of the bone. The knife passed easily through the shell of bone, allowing a serous fluid to escape. The cavity was without trabeculation and lined with a smooth membrane



Fig. 643.—Specimen from bone cyst in the right femur taken on the edge of the cortex, showing (a) bone, (b) giant-cell (one found in four slides examined) (c) area of fibrosis, (d) blood-vessel

which the pathologist reported to be inflammatory (Fig. 647). The patient was discharged with a figure-of-8 spica cast. The prognosis is good.

Cystic disease of the long bones has a number of characteristic features. It usually appears before the patient is thirty years of age. It is always in the diaphysis. After slow growth it appears to move upward and is most common in the proximal end of the shaft. If the cyst is single it usually arises from the center of

the bone, and enlarges slowly at the expense of the cancellous bone leaving a fairly clear line of demarcation. It does not cause thickening of the periosteum and tends to grow away from rather than toward the epiphysis. The condition causes little or no pain, unless there is secondary infection but limp deformity and fracture often occur. If the cyst becomes multilocular it presents a series of translucent areas surrounded by striae of irregular outline known as trabeculations. The cortex, being gradually encroached on, becomes thin or fused with the medullary substance so that there are areas in which only the outline of the cortex can be made out. As the process continues the periosteum bulges out and may become irregular but in these benign growths does not burst its bounds and invade the soft tissue, as is usual in the malignant growths. Later the bone having lost its normal structure, it becomes weak and fractures on moderate trauma. The limb should be immobilized in plaster following operation. The history, clinical findings, and laboratory and roentgenographic reports should be considered in making a differential diagnosis of cystic disease of the long bones, which in the past, unfortunately has been confounded with malignancy (Fig. 648).

CASE III (353,061)

Mrs. M. M. aged forty five years, came to the Clinic March 21, 1921. In 1910 she had begun having severe shooting knife-like pain in the lower portion of the abdomen extending down both legs. She had noticed that since 1910 she had become about 2 inches shorter. For six years she had had considerable difficulty in walking.

Physical examination revealed a bowing of both femurs and tibias and stiffness of the vertebral column. A marked crease in the abdominal wall just below the costal margin was noted, the result of shortening of the vertebral column.

Roentgenograms of the pelvic bones and femurs revealed marked rarefaction. The tables of the skull were only slightly

thickened. Osteomalacia and Paget's disease were considered for differential diagnosis; osteomalacia was favored because of rarefaction instead of eburnation of the pelvic bones and because of the apparently normal tables of the skull.

The case presents a picture long recognized as osteomalacia associated with pregnancy. The patient had been married at the age of sixteen years. She had had repeated pregnancies, had worked hard and had had several illnesses, all of which may have a bearing on the condition. The altered calcium content in the osseous system, softening of the bone with increase in size of the medulla and thinning of the cortex are characteristic. The lower extremities bend due to the weight of the body and the bone softening. The spinal column bows forward and the vertebral bodies crush under the supported weight. Often sharp shooting pains are complained of and *corna vara*, flat feet, and other deformities occur. The patient becomes short in stature and the legs bow outward. Not infrequently patients observed early may be believed to have chronic infectious arthritis. Osteomalacia occurs in another type such as is now reported in Europe in undernourished males who have been compelled to work while being starved of lime, phosphorus, and vitamins. Unfortunately curative treatment has not been found for these patients. They must be treated by supportive measures to maintain general health. Fractures apparently heal with very little callus. I have never seen non-union in one of these cases.

CASE IV (A308,228)

Mr. T. W. W., aged thirty-five years, came to the Clinic for examination August 19, 1921. He complained of non-union of a fracture of the left leg a short distance below the knee sustained in a fall from a building in 1916. He had worked in an iron foundry until the time of the accident; since then he had worked on a farm. He had not had previous illnesses and denied venereal disease. He had formerly drunk to excess and in 1916 and 1917 he had used morphin, taking as high as 30 grams daily. He stated that he had not taken morphin since 1917. The fracture was reduced at the time of the injury; the overlying wound

was closed by suture and primary union followed. The leg was placed in a fracture-box for three months and in a plaster cast for four months. After this crutches were necessary for a time and then a cane the leg never seemed very solid. In 1917 his leg turned under him and he fell a few feet. Shortly after this



Fig. 619—(Case A369,228.) A roentgenogram of ununited fracture. Close inspection will reveal the layers of the bone-graft inserted elsewhere. There is evidence of pseudo-arthritis.

a sliding bone-graft operation was performed on the tibia. The leg was in a cast for three months and crutches were used for four months. He then walked with a cane. Non-union resulted from this operation. The patient stated that he believed he had fractured the graft in his struggles while recovering from the anesthetic.

Examination revealed the bridge of the patient's nose to be slightly sunken and a perforation of the septum with beaked edges. There were many scars over the arms and shoulders from hypodermic punctures. There was abnormal mobility in the upper third of the left leg and the entire weight of the body placed on this leg caused a tendency to outward and posterior bending. Roentgenograms revealed a fracture of the upper third of the tibia, with the fragments in good position, and a marked thickening and irregularity of the fibula. The Wassermann reaction was positive. The diagnosis of syphilis was confirmed and treatment for syphilis prescribed. A cast was applied to the leg and the patient was allowed to walk while receiving treatment for syphilis. This prevents deformity becoming exaggerated and union may occur without operative interference.

It has been our experience that non-union is not often caused by syphilis. In a large number of cases observed in the Clinic of non-union (400) syphilis was a negligible factor. The patient's statement that he fractured the graft in his struggle on awaking from the anesthetic demonstrates the necessity of perfect fixation in plaster following any operation in which the bone-graft is used. Failure of fixation is very often the cause of failure in these cases. Operations should always be deferred until treatment for syphilis has been carried to a point satisfactory to the syphilologist (Fig 649)

CASE V (AM7,830)

Mr G W aged thirty-seven years, registered at the Clinic August 9 1921 complaining of pain in the right knee. He had wrenched it in a jump from a wagon in 1903. There was no locking or swelling. Two operations had been performed without appreciable results. In 1919 he had contracted influenza, and the knee had become very painful and swollen. He was unable to extend the leg. A piece of cartilage had been removed from the knee with only slight improvement. His knee became progressively worse and he was obliged to use crutches.

On examination the patient was found to be in good general

condition. The temperature pulse and blood-pressure were normal. The enlarged right knee was markedly tender and painful it was held at fixation of 160 degrees. The urine contained an occasional pus-cell. The hemoglobin was 70 per cent. and the leukocyte count 11,600. The Wassermann reaction on the blood was negative. Destructive arthritis of the right knee with considerable synovial thickening was shown in the roentgenogram.

August 13th the right knee-joint was opened and a sarcoma of the periosteum of the mixed-cell type was discovered. The tumor had originated on the posterior surface of the lower part of the femur and had pushed its way through to the anterior part of the joint. The thigh was amputated and x ray radium and Coley's treatment were given.

When we examined the patient we believed that his condition might be tuberculous. He was warned, however of the possibility of sarcoma, and his consent was obtained for an amputation if it should be necessary. The points of interest in the history of the case are that eighteen years before the knee had been injured it had been operated on elsewhere twice. During these years there was occasional stiffness and soreness in the knee. In 1919 following influenza the knee became so swollen it could not be straightened. Operations had been performed elsewhere and a cartilage removed, with slight improvement. During the last six months the pain had been much more severe and during the last two months the enlargement had been rapid. Whether the old inflammation had anything to do with the cause of the sarcoma is difficult to determine but a few cases have been observed in the Clinic in which there had been a long history of trouble of the knee-joint and an apparently rapid development of sarcoma. So far as we could judge the sarcoma in this case seemed to arise from the periosteum in the posterior part of the femur just about the epiphyseal line. Primary sarcomas of the synovia are rare, and this case would have been regarded as a primary sarcoma of the synovia if the cross-section of the specimen had not determined accurately its origin.

The prognosis in these cases is poor not more than 4 per cent.

of the patients live longer than three years. Death is usually directly due to metastasis to the lungs. Treatment with radium



Fig. 650—(Case A367,850.) Periosteal sarcoma of the femur just about the epiphyseal line. The tumor extended into the knee-joint and even into the suprapatellar pouch, simulating tuberculosis in appearance.

and x ray is advised benefit may be obtained with Coley's serum (Fig. 650)

CLINIC OF DR. WALTER E. SISTRUNK

CANCER OF THE BREAST

THIS patient (Case A367 971) Mrs. J. D. aged forty five years, first noticed a painless tumor in the right breast two weeks ago. There has been no discharge from the nipple. Examination shows a tumor 2 cm. in diameter in the upper outer quadrant of the breast, and attached to the skin. Enlarged glands cannot be felt in the axilla.

In the greater number of patients a clinical diagnosis of cancer of the breast can be made. The tumors are usually hard, and very early in their course cause an inflammatory reaction which, in turn, causes contraction of the fibrous tissue trabeculae lying between the growth and the skin, thus giving to the palpating hand a feel that the growth is attached to the skin. Such tumors almost invariably prove to be malignant. In cases in which this attachment is not apparent but the tumor is hard, with indefinite edges which seem to extend into the tissue of the breast, the diagnosis is established. Most cancers of the breast enlarge slowly although the rapidity of growth varies. It is not unusual to see a malignant tumor which has remained practically stationary for a number of months suddenly enlarge, rapidly involve the skin and ulcerate.

The results obtained from operation depend largely on the extent of the disease at the time of operation. The statistics in the Clinic show that 64 per cent. of the patients operated on before the glands become involved, regardless of the duration of the disease live from five to eight years after operation. When the glands are involved only 19 per cent. live for this length of time. These statistics are based on consecutive patients traced, and from them it may be assumed that if all

patients with cancer of the breast were operated on very early in the course of the disease 75 or 80 per cent. would obtain from five year to eight year cures.

Unfortunately the greater number of patients with cancer of the breast are seen late in the course of the disease. In a group of 218 patients studied recently the glands were found to be involved in 60.5 per cent. Diffuse carcinomas with glandular involvement were found in 16 patients, and extensive ulcerating growths in 20. Improvement in results will undoubtedly be

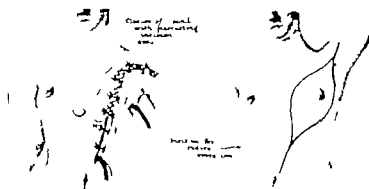


Fig. 651—*a*, The wound after the edges of skin have been provoked. *b*, Outline for incision in the radical amputation of the breast.

obtained only by operating earlier since it does not seem likely that a change in the operation as it is now performed will materially affect the end results.

In performing the radical amputation we remove the skin and subcutaneous fat widely and sacrifice both pectoral muscles. The axillary lymphatics are then dissected with removal of the glands and fascia from the infraclavicular triangles. A portion of the fascia covering the upper portion of the rectus muscle is also removed. The posterior thoracic and the long subscapular

nerves are preserved. A slight modification of the Rodman incision is used, and in practically all instances it is possible to

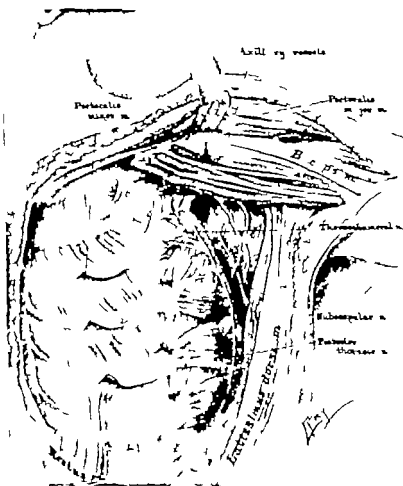


Fig. 652.—Dissection complete and the vessels tied. The posterior thoracic nerve and the long subscapular nerves are left intact.

unit the edges of the skin at the close of the operation (Figs. 651-652). Following such operations the function of the arm

is almost perfect. Impairment of function is seen only in patients who are tired and fall, on account of pain, systematically to exercise the arm. The work of Handley has tended to show that when the skin becomes involved the malignancy diffuses through the lymphatics of the skin for a considerable distance beyond the growth, and in such cases it is necessary to remove widely the skin surrounding the involved area in order to prevent recurrence.

Recurrences seldom develop in the axilla following operation even in cases in which the axillary glands are involved, and local recurrences occur in only 10.5 per cent. of the cases in which the glands are not involved. It is probable that the majority of recurrences in early cases is owing to carcinomatous tissue, inaccessible to the knife which was not removed. Possibly some improvement in results may be obtained by intensive x ray or radium treatment before or during the operation.

In the series of 218 patients the cancer occurred most often in the upper half of the breast (46.8 per cent.) and least often in the lower half. The largest number of cures was in cases in which the growth was located in the upper inner quadrant (52.6 per cent.) and the smallest number in cases in which it was located in the lower inner quadrant (25 per cent.) The lymphatic drainage from the lower inner quadrant is probably largely through the vessels accompanying the branches of the internal mammary and intercostal arteries lymphatics which cannot be removed surgically; thus, no doubt, accounts for the marked differences in results (Fig 653).

Certain types of cancer seem to be highly malignant. For example we have found that cancers occurring in pregnant and lactating women are practically always fatal. The diffuse growths which apparently develop on pre-existing mastitis and involve the entire breast always produce death. Recurrences in the order of frequency are in local areas, the chest, the bones (the spine as a rule), the abdominal cavity and the brain respectively. In our patients with local recurrences metastasis was demonstrated at some other point in 60.5 per cent., a complication which should be considered in operating for local recur

rence. Two and a half per cent. of the 218 patients died within six months after operation. 21.1 per cent. were dead at the end

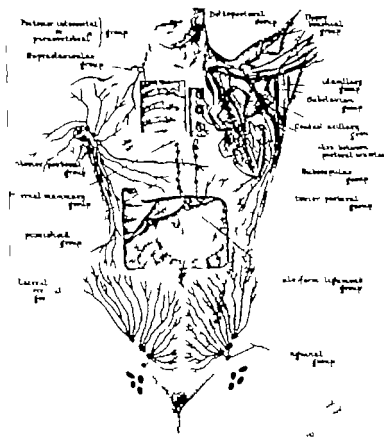


Fig. 653 — The lymphatic drainage of the breast. The red dots represent the terminal lymph nodes that drain the breast. The black lines and dots represent lymphatic systems which are more or less directly related to the accessory system of lymphatics (after Decker and MacFarland)

of the first year 34.9 per cent. at the end of two years 42.4 per cent. at the end of three years 49.1 per cent. at the end of four years 55 per cent. at the end of five years. Only 2.3

per cent. died after five years. Freedom from recurrence for three years certainly does not constitute a cure. Freedom for five years offers a much better chance for cure we have seen very few recurrences after eight years, although they have been reported from twelve to thirty years after operation. Nine of the 80 patients (36.7 per cent.) of the group of 218 who are alive from five to eight years after operation are known to have recurrences. Eighty-five (39 per cent.) were alive at the end of five years. These results are almost identical with those reported by Judd and me in 1914 in a group of 510 patients, 39.8 per cent. of whom obtained five-year cures.

Even simple operations offer an excellent chance for cure in early cancer. The histories of 6 patients in whom a simple amputation had been performed for supposed mastitis, later found by the pathologist to be definite cancer show that 1 patient lived eight years, 2 patients lived seven years, and 1 patient lived six years. One patient died four years after operation but we were unable to ascertain the cause of death. One patient was alive and without recurrence when last heard from two years after operation. It is our practice in questionable cases to remove the tumor with a good margin of the breast tissue surrounding it, and to have an immediate diagnosis made from a frozen section. So far as we are able to ascertain, when this procedure has been followed by an immediate radical amputation, the prognosis has not been affected.

CYSTS OF THE THYROGLOSSAL TRACT

Mr A. S. (Case A311,227) has had this tumor in the middle line of the neck since he was twenty-three years of age nearly thirty years. For two or three years it has been increasing slowly in size, but it has never been painful or tender. It has not been treated. The tumor is soft, fluctuating and painless, about 4 by 4.5 cm in diameter. It can be palpated in the anterior middle line of the neck a little below the thyroid cartilage.

Cysts of the thyroglossal tract develop through failure of complete obliteration of the epithelium which is carried down by the descent of the thyroid gland. Very early in fetal life the thyroid gland develops at the base of the tongue and descends in the middle line of the neck to its normal position. Normally the epithelium lining the tract through which the thyroid descends disappears. If the epithelium fails to disappear isolated areas of thyroid tissue (aberrant thyroid) or cysts may develop along its course (Figs. 654-655).

The diagnosis of cyst of the thyroglossal tract is, as a rule not difficult, and is made by finding a rather firm cystic tumor in the middle line of the neck usually near the hyoid bone or the thyroid cartilage. Usually the duct, which runs from the cyst to the hyoid bone may be palpated. In some cases the cyst becomes infected and forms an abscess, which, on rupturing or being opened leaves a sinus that may persist for a number of years.

The cure of the condition necessitates complete removal of the epithelium-lined tract. Unless the tract is removed completely the condition often recurs. As a rule the cyst and the portion of the tract lying below the hyoid bone may be dissected out without difficulty but above the hyoid bone the tract is so small and friable that it is broken off easily and consequently is difficult to remove. The highest percentage of cures is obtained through an operation in which a portion of the hyoid bone, the

thyroglossal tract, and the tissues surrounding it are removed without an attempt definitely to isolate the duct.

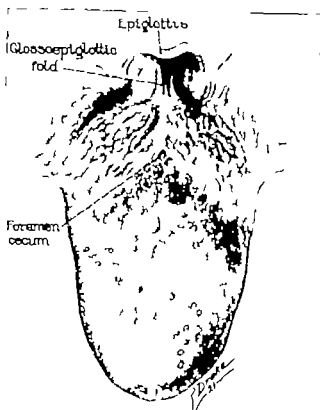


Fig. 654.—Anatomy of the dorsal surface of the tongue and the position of the foramen cecum.

We usually perform the operation through a transverse incision, about 5 cm. long across the neck at the level of the hyoid bone. The skin and platysma muscles are reflected. The cyst is found lying between the raphe connecting the sternohyoid

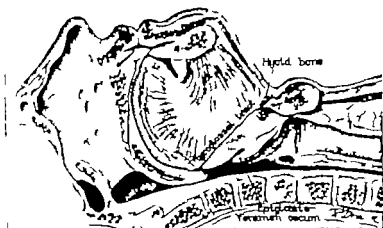


Fig. 655.—The thyroglossal tract with cyst in the position usual in such cases.

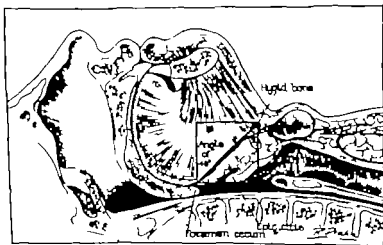


Fig. 656.—The line along which the dissection must be carried in order to remove completely the thyroglossal tract.

muscles. It is dissected free up to the hyoid bone (Fig. 656). At this point the tract usually passes through the hyoid bone

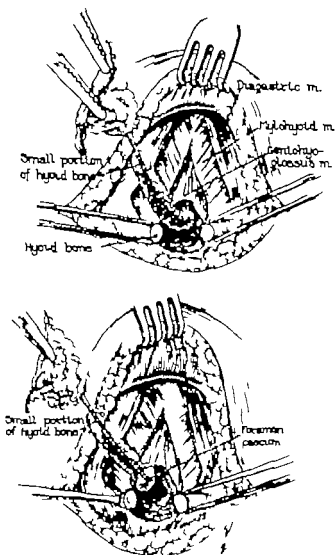


Fig. 657.—Steps of operation. The thyroglossal duct cyst is removed with the portion of the thyroglossal tract lying between the hyoid bone and the foreman caecum.

although it may be found passing either above or below it. The muscles are separated from the center of the hyoid bone and about 0.3 cm. of the bone is removed then without any attempt to isolate the duct, the tissues are cored out from this point directly to the foramen cecum, and the duct with the tissues surrounding it for a distance of about 0.3 cm. on every side is removed (Fig. 657). In doing this it is necessary to keep clearly in mind the direction of the foramen cecum. This corresponds to a line drawn at an angle of 45 degrees, backward and upward through the intersection of lines drawn horizontal and perpendicular to the superior central portion of the hyoid bone. In the dissection, the duct, a portion of the hyoid bone, a portion of the raphe joining the mylohyoid muscles, a portion of each of the geniohyoglossus muscles, and the foramen cecum are removed. The opening in the mouth is closed and the geniohyoglossus muscles are drawn together with interrupted catgut sutures. The tissues surrounding the cut ends of the hyoid bone are brought together with chromic catgut sutures in such a manner as to approximate the edges of bone. A small rubber tube is introduced down to this point and the skin closed. Since this type of operation has been used in the Clinic all the patients operated on as far as I have been able to ascertain, have been cured, whereas previously operative procedures often failed to effect a cure.

TUMOR OF THE PAROTID GLAND

Mrs. J. T. (Case A262,680) aged fifty-eight years came for consultation because of this small tumor a little above the jaw bone in front of the ear. As long as she can remember she has had a small nodule in this location. For the last year the tumor has increased in size. The tumor is hard and movable, about 4 by 5 cm. in diameter and is in front of the ear about 2.5 cm. above the angle of the jaw-bone.

Our statistics show that mixed tumors of the parotid gland occur in one of every 1607 patients examined. Tumors of the salivary glands occur eleven or twelve times as often in the parotid glands as in the submaxillary salivary glands, and are practically never found in the sublingual salivary glands. They are found with about equal frequency on the right and left sides. The tumors are painless encapsulated firm and small rounded, or irregular shaped. The rapidity of growth varies in some instances it is very rapid in others it remains stationary for a number of years. As long as the growth remains encapsulated it is not highly malignant and if the entire tumor with its capsule is removed cure is effected. If however the capsule is ruptured through trauma, or if an incomplete operation is performed the growth invades the tissues surrounding it and often undergoes more malignant change. In such instances metastasis may occur in the lymphatics draining this region.

Pathologists differ in their opinions with regard to the etiology of these tumors many believe that the tumors originate from encapsulated fetal rests in the parotid. Pathologically the tumors have been classified as mesotheliomas, carcinomas, and basal-cell epitheliomas. In some instances the tissue on the interior of the capsule is composed largely of epithelial elements in some tissue resembling cartilage predominates and in others a large amount of the tissue is fibrous. Often sections from different portions of the same tumor show very different microscopic pictures.

facial paralysis, refuse to submit to operation. Surgery seems to be about the only means of successfully treating the condition. Thus far we have not had cures following the use of x ray or radium.

In operating an oblique incision is usually made in the skin along the creases of the neck at a point about 1.8 cm below

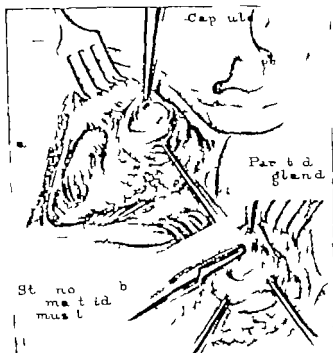


Fig. 639—*a*, Skin and platysma muscle reflected and the parotid tissue covering the tumor retracted in the direction of the fibers of the facial nerve. *b*, Excision of tumor by blunt dissection with a pointed hemostat.

the angle of the jaw and extending from the lower portion of the mastoid process for about 7.5 cm toward the thyroid cartilage (Fig. 638). The skin and subcutaneous fat are reflected upward and the parotid gland exposed. The tumors usually are in the anterior portion of the gland and anterior to the facial nerve, which passes through the posterior portion of the gland.

Were it not for the fact that facial paralysis follows the removal of the parotid gland, the entire gland could be removed from patients who come for treatment early in the disease, and practically all the patients would be cured. Such a procedure is



Fig. 658.—Incision along crease in the neck which usually is employed in the removal of parotid tumors

usually followed when tumors are found in the submaxillary salivary gland. Many incomplete operations are performed in efforts to avoid the facial nerve, with resulting recurrences, and many tumors grow to a large size because patients, fearing

previously however a large amount of fibrous tissue is usually found which adds considerably to the difficulty of complete removal. In such cases and in cases in which the tumor has been allowed to attain considerable size injury to the nerve may be avoided sometimes through the following procedure. The inframandibular branch of the facial nerve is isolated as it runs

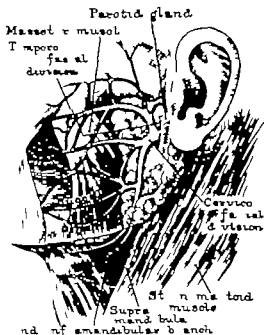


Fig. 661.—Anatomy of facial nerve as it passes through the parotid gland. The anterior portion of the gland has been removed.

around the angle of the jaw beneath the platysma muscle at a point about 1.5 cm. below the angle. This nerve is dissected up through the substance of the parotid gland to the division of the facial nerve into the temporal and cervical. The tumor nearly always is found lying anterior to the nerve. If a finger is introduced between the nerve and the portion of the parotid which has been lifted from the nerve (Fig. 662) the surgeon may feel

A transverse incision is made in the direction of the branches of the facial nerve through the parotid tissue down to the encapsulated tumor which is enucleated by blunt dissection (Fig. 659). Often the capsule is very thin and ruptures during removal. In this event extreme care should be used to remove the capsule. If it collapses after a portion of its contents has escaped a small piece of gauze may be packed into the cavity in order to distend the sac and define its outline and thus aid in its removal. After the tumor has been removed the wound is washed with salt

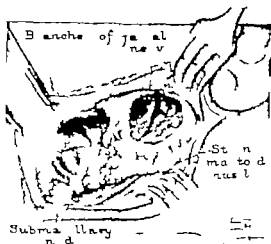


Fig. 660.—Cavity in the parotid gland after removal of the tumor. Facial nerve in the bottom of the cavity.

solution in order to remove as well as possible all cellular elements which may have escaped from the sac, and swabbed with Harrington's solution (strong solution of bichlorid of mercury with hydrochloric acid in alcohol) in order to destroy any cells which may be lying free in the wound. The cavity is then packed with a small strip of gauze saturated with Harrington's solution (Fig. 660).

As a primary operation such a procedure is not difficult, and if the tumor is small a cure can be effected without injury to the nerve (Fig. 661). In patients who have been operated on

operated on for recurring growths are alive, 37.8 per cent. with recurrences, and 10.8 per cent. are dead. There were no deaths following operation in this series. The most serious complications following operation are partial or complete facial paralysis and salivary fistulae. Sixteen of the 66 patients on whom primary operations were performed had temporary paralysis for from six weeks to one year. One patient had permanent partial paralysis and one permanent complete paralysis. Sixteen of the 37 patients operated on for recurring growths had temporary paralysis with a return of the function of the nerve after periods varying from six weeks to one year while 2 of these patients had permanent complete paralysis and 5 permanent partial paralysis. One of the patients who had a primary operation developed a salivary fistula which has persisted for five years and nine months, and one patient operated on for a recurring tumor developed a salivary fistula which has persisted for seven years.

confident that the enucleation is being carried on in a plane lying above the nerve and, although a temporary paralysis may occur from traumatism to the nerve it usually disappears within a year.

The results following the surgical removal of parotid tumors are indeed, excellent. Recently I studied the histories of 66



Fig. 662.—Method sometimes used in trying to prevent injury to the facial nerve. The facial nerve has been exposed and separated from the anterior portion of the parotid gland. A finger is kept in front of the nerve while the tumor is being removed.

consecutive patients who were traced, on whom primary operations had been performed from one to five years previously and of 37 patients on whom operation had been performed for recurring tumors. It was found that 93.4 per cent. of the patients who had primary operations were alive, 18.3 per cent. with recurrences, and 6.6 per cent. are dead. 89.2 per cent. of the patients

ELEPHANTIASIS

Mr. C. A. J (Case A308 040) who is fifty years of age, first came to the Clinic in March, 1920. When he was seven or eight years old he first noticed swelling of the left ankle in the evening which disappeared by morning. The swelling gradually spread upward until at the age of twelve it involved the leg as high as the knee. At eighteen years he had several attacks of inflammation in the leg with local swelling and redness of the skin which were associated with chills and fever probably erysipelas. Within two years there was a huge enlargement of the leg extending to the groin. Rest in bed, elevation, and cathartics always caused reduction in the size of the limb.

At the time of admission to the Clinic the patient had a tremendous enlargement of the left leg thigh and foot, with large localized areas of edema and thickening of the skin (Figs. 663-664). Measurements of the two lower extremities were

Thigh at the trochanter	right leg 20 inches
	left leg 32 inches
Middle of thigh	right leg 18 inches
	left leg 45 inches
Knee	right leg 16 inches
	left leg 35½ inches
Middle of leg	right leg 13½ inches
	left leg 57 inches
Ankle	right leg 6 inches
	left leg 22½ inches

The patient's weight was 340 pounds. The blood was negative for filaria. Rest in bed to reduce the size of the leg was advised, and if the results were favorable, operation. For business reasons the patient went home promising to return later.

In January of this year the patient was readmitted to the Clinic. He was treated for two months by rest in bed, with elevation and bandaging of the affected limb and cathartics. During this time he lost 100 pounds in weight and the limb



Fig. 667

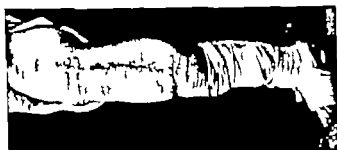


Fig. 666

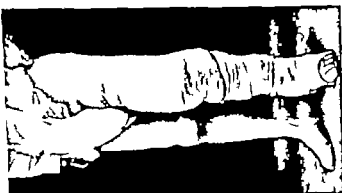


Fig. 665

Figs. 665-667—(Case A306,040.) Following the third operation (June 11, 1921) the wound in the thigh, except for about 3 cm. healed by first intention. The areas near the ankle sloughed. July 14th the patient left the hospital with the wound in the thigh healed and the ankle in good condition.

surface of the thigh. Small calcareous nodules, which had probably resulted from venous thrombosis, were scattered

diminished considerably in size. The skin which had been very hard and tense became saggy and pendulous.



Fig. 604.

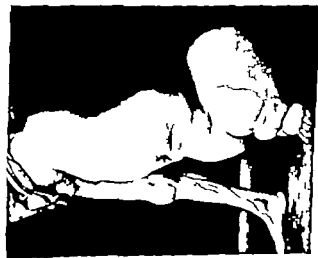


Fig. 603.

Figs. 603, 604 — (Case A308,040.) The patient on admission to the Clinic March 5, 1920.

In March a modified Koodoleon operation was performed. Thirty-four pounds of skin, subcutaneous fat, and aponeurosis were removed in one piece through an incision on the posterior

we have obtained green-producing streptococci. The disease if left untreated, tends to grow progressively worse, and in many instances eventually is characterized by recurring attacks of erysipelas, each of which is followed by an increase in the size of the limb.

The pathologic picture is tremendous thickening of the dermis, of the connective-tissue trabeculae lying between the dermis and aponeurosis and of the deep aponeurosis. The *epithelial layer of the skin is thinned out through stretching by the edema in the tissues below it, and the elastic fibers largely disappear.* The lymph-channels which have not been destroyed by infection are markedly dilated, and extravasated lymph is present in the subcutaneous fat. Areas of round-cell infiltration are found scattered throughout the hypertrophied connective tissue.

In 1912 Kondoleon suggested an operation for elephantiasis which is somewhat similar to operations formerly suggested by Lanz, von Oppel, and Rosanow in which the disease is treated by removing large amounts of skin, subcutaneous fat, and deep aponeurosis from each side of the affected limb. Such a procedure removes a large amount of obstructed lymphatic tissue which is incapable of carrying on normal function. The aponeurosis covering the muscles seems definitely to separate the superficial and deep lymphatic systems, and when a large amount of this tissue is removed and the skin allowed to drop down on and become attached to the muscles new blood vessels and lymphatics form which connect the deep and superficial lymphatic systems. The disease even in extreme cases, involves only the tissues lying above the deep aponeurosis, and when the deep and superficial circulations are connected in this manner the deep lymphatics evidently help to drain the obstructed superficial system.

In mild cases the operation can usually be performed without preoperative preparation, but in patients with marked enlargement, and especially in patients with marked deformity the best results follow prolonged rest in bed with elevation and bandaging of the affected limb. The operation is extensive and

throughout the subcutaneous fat. Very large spaces containing straw-colored fluid evidently were completely blocked lymph-spaces.

During the following month in the hospital the patient was treated with lights over the left leg and dry dressings. Twice sloughing tissue was removed. The seropurulent drainage decreased to practically nil.

By the end of April a second operation was possible. At this time the incision was also in the posterior surface of the thigh a large amount of skin, subcutaneous fat, and aponeurosis was removed. The leg was treated with lights. About May 15th a bandage was applied. The wound healed without drainage or induration. A week ago the patient was dismissed from the hospital with the leg in a bandage.

Today through a long incision on the outer aspect of the leg from the crest of the ilium to the knee another large piece of skin, subcutaneous fat, and aponeurosis will be removed (Figs. 665-667). These irregular lumps just above the ankle will be removed through transverse incisions, and the area on the dorsal surface of the foot through a longitudinal incision. Sloughing in these areas may be expected.

The patient will be asked to return for another operation on the inner side of the leg and thigh.

Our ideas with regard to the cause of elephantiasis have changed in recent years we no longer think of *filariasis* as the most likely cause. The condition usually develops secondary to an obstruction of the lymphatic or venous circulation of the affected area. Simple lymphedema if untreated is liable to be supplemented by elephantiasis. It always precedes elephantiasis. Stagnation of lymph in tissues predisposes them to infection by micro-organisms, and following such infection an obliterative lymphangitis and hypertrophy of the connective-tissue elements of the skin, subcutaneous tissues, and deep aponeurosis may result. Experimental work tends to show that true elephantiasis probably always develops secondary to chronic infection of the tissues by micro-organisms usually some type of streptococcus. From several of the patients operated on in the Clinic

we have obtained green-producing streptococci. The disease, if left untreated tends to grow progressively worse, and in many instances eventually is characterized by recurring attacks of erysipelas, each of which is followed by an increase in the size of the limb.

The pathologic picture is tremendous thickening of the dermis of the connective-tissue trabeculae lying between the dermis and aponeurosis, and of the deep aponeurosis. The epithelial layer of the skin is thinned out through stretching by the edema in the tissues below it, and the elastic fibers largely disappear. The lymph-channels which have not been destroyed by infection are markedly dilated and extravasated lymph is present in the subcutaneous fat. Areas of round-cell infiltration are found scattered throughout the hypertrophied connective tissue.

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is best performed in stages in some instances three or four operations are necessary to obtain good results. Considerable time may be required for new lymphatics to form and during this period it is necessary that the limb be bandaged firmly in order to prevent edema. Usually we have found it comparatively easy to control the edema following an operation in patients in whom this was impossible before operation. It seems probable that the prevention of lymph stasis after operation helps to rid the tissues of the streptococcal infection. It is best for patients distinctly to understand before the operation is attempted that it is to control a disease which tends to grow worse progressively unless operation is performed, and that it is impossible to expect the operation to restore the limb to normal also that it will be necessary to bandage the limb for an indefinite period following operation.

The Kondoleon operation is now performed as follows. A long modified elliptic incision, which includes the skin to be sacrificed, is made on one side of the affected limb. On the outer aspect of one of the lower extremities this incision extends from the crest of the ilium to a point a little below the external malleolus of the tibia. Then, in order to facilitate a wide removal of the subcutaneous fat, the skin is reflected on each side of the incision for a distance of about 4 cm. The skin is then retracted and underneath each of the edges of reflected skin a long incision is made through the edematous subcutaneous fat down to and including the aponeurosis. These incisions are made almost parallel with the original skin incision. Included between them is a quadrilateral piece of edematous fat and aponeurosis. The two incisions through the aponeurosis are connected at their upper ends by a transverse incision. The tissues to be removed are then free except for the attachment of the aponeurosis to the underlying muscles. By tracting these tissues it is easy to dissect the aponeurosis from the muscles throughout the length of the entire limb and to remove in one long piece the skin, edematous fat, and aponeurosis. The skin with small amount of subcutaneous fat underneath it is allowed to drop down upon the muscles and the wound is closed with interrupted silkworm-

gut sutures, without drainage. It is usually necessary to perform a similar operation on the opposite side of the limb.

On account of the shock which may accompany an operation of this type the patient is given a hypodermic injection of $\frac{1}{4}$ grain morphin one-half hour before the operation is begun. Only one side is operated on at a time. The patient is also treated as though he were suffering from shock for eight or ten hours following the operation. He is usually kept in bed for ten days after the operation, and at least two weeks are allowed to elapse before the second operation is performed.

The results following the Kondoleon operation have been, as a whole, very satisfactory. The limb is usually reduced nearly to normal size, and, if proper co-operation on the part of the patient is secured and bandages properly used, the limb will remain almost normal in size.

